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THE TIMBER SUPPLY SITUATION in GEORGIA

Forest Service
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Forest Resource Report No. 12

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The Timber Supply Situation in Georgia

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SOUTHEASTERN FOREST EXPERIMENT STATION

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Preface

NEARLY 20 YEARS have passed since the first inventory of Georgia's forests was completed in 1936. During this period annual production of lumber in Georgia more than doubled. Pulpwood production jumped from 200,000 cords in 1937 to 3.1 million cords in 1954. Georgia now produces more pulpwood and lumber than any other State in the South.

Since 1936, over 16 million acres of forest land have been put under organized fire protection. Pine trees have been planted on more than one-half million acres. About 8 million acres of forest land have been put under management. During the 19 years that the Naval Stores Conservation Program has been in operation, turpentining practices have steadily improved.

To get an accurate measure of the impact of these events on Georgia's timber supply, a second inventory of the State's forests was begun in July 1950. In November 1953 the last of 12,000 ground survey plots was taken. The findings of this second survey furnish the background for an understanding of the present forest conditions in Georgia and focus attention upon the principal forest problems and what needs to be done to solve them. No attempt is made to fully evaluate the use of forests for wildlife, recreation, or grazing; these uses are discussed only as they affect the timber supply.

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Summary of Survey Findings

DOES GEORGIA HAVE ENOUGH FOREST LAND TO GROW THE KIND AND AMOUNT OF TIMBER IT NEEDS? Georgia has 24 million acres, or 65 percent of its land area, in forests. The outlook is for an even greater area. Between surveys, forest area increased by 2.6 million acres. Most of this increase was on abandoned farmlands that have been allowed to come back into forest. More abandoned farmland can be expected to revert to forest.

Only two-thirds of Georgia's forest land now supports pine types, although 80 percent or more of it is capable of growing pine. Practically all the upland sites grew pine at one time or another in the past. Less than 15 percent is rated as poor site. Georgia also has over 6 million acres capable of growing good-quality hardwoods. Growth of the kind of timber Georgia needs could be doubled.

DOES GEORGIA'S TIMBER SUPPLY FIT THE NEEDS OF ITS FOREST INDUSTRIES? Unfortunately, much of the timber now growing on Georgia's forest land is not the kind forest industries are using. Only 36 percent of it is large enough or of good enough quality to make saw logs. Yet forest industries depend upon this kind of timber to supply nearly two-thirds of their annual timber needs. Four-fifths of the sawtimber cut is pine, but pine makes up only 58 percent of the volume of standing sawtimber.

Forest industries make little use of the large volume of oaks. Gum and yellow-poplar provide two-thirds of the annual cut of hardwood sawtimber. Also, few hardwood trees under 14 inches are cut. A third of the hardwood sawtimber cut comes from gum and yellow-poplar trees 20 inches and larger; but this kind of timber makes up less than 10 percent of the standing hardwood sawtimber.

WHAT IS THE TREND IN THE SUPPLY OF THE KIND OF TIMBER FOREST INDUSTRIES NEED? The trend in the volume of pine and high-quality hardwood sawtimber is down. Georgia now has 15 percent less pine sawtimber than it had 18 years ago. Pine sawtimber volume is still dropping almost as fast as it did during the period between surveys. Hardwood sawtimber declined 11 percent. In recent years, however, hardwood growth has overtaken the cut. At the present time, hardwood sawtimber is increasing, but mainly because so little of the large volume of low-quality trees is being used. The remaining volume of high-quality gum and yellow-poplar is being rapidly cut out.

WHAT IS THE TREND IN YOUNG TIMBER? Young timber is increasing. Only the tremendous upsurge in the number of young trees prevented a more serious drop in sawtimber volume. Between surveys, pine poletimber increased almost enough to offset the drop in pine sawtimber. And currently, the annual increase in pine poletimber is slightly more than enough to offset the drop in sawtimber. The number of pine trees 1 inch and larger increased 41 percent. The number of young hardwoods increased even more than pine.

WHAT IS HAPPENING TO THE LOW-QUALITY TIMBER IN THE STANDS? Much of the growing space formerly occupied by pine and the better quality hardwoods is being taken over by culls and low-quality hardwoods. Between surveys enough pine type was converted to hardwood type through cutting to reduce the pine type by 844,000 acres. Also, during this same period the volume in cull trees, principally hardwoods, more than doubled.

WHY ISN'T LAND GROWING MORE OF THE DESIRABLE KIND OF TIMBER? Georgia has plenty of forest land but is short of the right kind of trees to stock it. A fourth of the forest area is poorly stocked; only about half is fully stocked. Many stands are well stocked only because of an abundance of low-quality hardwood seedlings and saplings. Less than 3 percent of the forest area is well stocked with sawtimber. An increase in stocking on much of the understocked land is seriously hampered by the presence of shrubs and cull trees. Cull trees one inch and larger, mostly hardwood, occupy about a third of the available growing space in Georgia and are taking the place of enough sound trees to stock 7.5 million acres.

HOW DID THE STANDS GET IN SUCH POOR CONDITION? The deficiency in desirable growing stock on Georgia's forest land reflects a long history of abuse. Year after year fire has destroyed untold numbers of young trees and made culls out of many it did not kill. Pine and the better quality hardwoods have been cut out of the stands repeatedly; frequently not enough desirable trees were left to provide an adequate seed source. The cull trees and the less desirable hardwoods were left to grow and take over more and more of the available growing space. Poor turpentining practices damaged the wood of many slash and longleaf pine trees to the extent that they were left in the woods to die.

HOW PREVALENT ARE THE PRACTICES THAT CONTRIBUTE TO POOR STAND CONDITIONS AT THE PRESENT TIME? Encouraging progress has been made toward improving forest practices since the first survey was made. Most of the forest land now has organized forest fire protection. The number of pine seedlings distributed for planting now exceeds 100 million a year. Most of the worked-out turpentined trees can now be used for pulpwood. Turpentining practices have improved. More and more land is being left with an adequate seed source following cutting. And some landowners are making a start toward getting rid of the poor-quality hardwoods.

However, in spite of this progress, poor forest practices are still contributing significantly to poor stand conditions. Wildfires still burn about one-half million acres of forest land every year. Annually, 350,000 acres of cutover land is left poorly stocked, 100,000 acres without an adequate seed source. Each year cutting converts 180,000 acres of pine and oak-pine types to hardwood types. Destructive wood chipping was still used on half the turpentine faces worked in 1954. There still is much room for improvement.

What Forests Mean to Georgia

FORESTS cover 24 million acres in Georgia, or 65 percent of the State's total land area. They represent a storehouse of 236 million cords of timber,[1] from which 10 million cords are cut annually for a wide variety of timber products, including saw logs, pulpwood bolts, veneer logs and bolts, fuelwood, piling, poles, hewn ties, and fence posts. Also, Georgia's forests are the Nation's principal source of naval stores. Annually, nearly a million barrels of crude gum are gathered from 47 million pine trees, and 100,000 tons of pine stumps are pushed out and processed for their pitch. In 1952 these primary forest products were worth 170 million dollars. This exceeded the value of cotton in 1952 (*15*),[2] Georgia's leading agricultural crop (fig. 1).

[1] Includes sawtimber, poletimber, cull trees, and hardwood limbs. The technical and uncommon terms used in this report, as well as certain common terms given special meaning, are defined on pages 46–48.

Forests Support a 600-Million-Dollar Industry

More than 3,000 establishments making lumber, furniture, and pulp and paper products depend upon Georgia's forests for raw materials (fig. 2). In 1952, products made by these industries were worth 592 million dollars and accounted for 15 percent of the total value of all manufacturing output in the State (*15*). Only food and textile products were worth more than the combined value of pulp, paper, lumber, and furniture products.

Georgia's forest industries provide jobs for 61,000 people (*6*). In 1954, 20 percent of the manufacturing

[2] Italic numbers in parentheses refer to Literature Cited, p. 43.

VALUE OF PRIMARY FOREST PRODUCTS

	MILLION DOLLARS	PERCENT
Saw logs	77	45
Pulpwood	34	20
Gum for naval stores	27	16
Fuelwood	16	9
Other products	16	10
Total	170	100

VALUE OF FARM FIELD CROPS

	MILLION DOLLARS	PERCENT
Cotton	157	39
Corn	69	17
Tobacco	63	16
Peanuts	46	11
Other crops	68	17
Total	403	100

FIGURE 1.—*The value of Georgia's primary forest products and leading farm crops, 1952.*

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FIGURE 2.—*Small sawmills such as this make up the largest share of the more than 3,000 manufacturing establishments dependent upon Georgia's forests for raw materials.*

workers were employed making pulp, paper, lumber products, and furniture. At least a fourth of a million people, or 7 percent of the State's population, depend upon forests for their livelihood. Only the textile industry employs more people than the forest industries.

Because of the rapid rise of the pulp and paper industry, forest industries have kept pace with the State's industrial progress. The relative importance of manufactured lumber and furniture products dropped, but this loss was offset by the increase in the importance of pulp and paper products. Between 1939 and 1952 the value of forest products in Georgia increased nearly sixfold, the same as the increase in value of all other manufactured products.

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FIGURE 3.—*Georgia's forests are becoming increasingly important as a source of recreation for its rapidly growing urban and suburban population.*

Not only has the rise of the pulp and paper industry meant more jobs for Georgia, but also better paid jobs. In 1954, the average weekly earnings paid by manufacturers of paper and allied products were higher than those paid by any other industry. The weekly earnings paid by makers of paper and allied products averaged $71.50 in 1954, compared to $49.66 by all manufacturers (*6*).

Other Forest Values

In addition to the wealth of timber and naval stores products, Georgia's forest land also provides grass and browse for cattle. In 1949, 4.4 million acres, or 33 percent of the total area of farm woodland, was pastured (*27*).

Forests also play an important part in safeguarding the State's water supply. Over a million and a half city residents, hundreds of factories, and many hydroelectric plants depend upon an even flow of clean water insured by an adequate forest cover on the State's watersheds.

Also among the long list of forest benefits are the hunting, fishing, picknicking, camping, and other forms of outdoor recreation provided each year by the forests for several million people (fig. 3).

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The Supply and Use of Timber

Sawtimber Main Source of Timber Products

GEORGIA'S FORESTS contain a total of 17.2 billion cubic feet, or 236 million cords of timber (*13*). However, forest industries make relatively little use of a large part of this volume included in cull trees and hardwood limbs. They depend mainly on timber large enough and of good enough quality to make saw logs. Timber suitable for saw logs makes up 36 percent of the all-timber volume, and 48 percent of the growing stock volume, which includes sawtimber and poletimber trees that show promise of becoming sawtimber (fig. 4).

Georgia's 37 billion board-foot supply of sawtimber provides forest industries with nearly two-thirds of their timber products. This annual cut amounts to 3 billion board-feet, or 8.2 percent of the sawtimber supply—slightly less than the current annual growth.

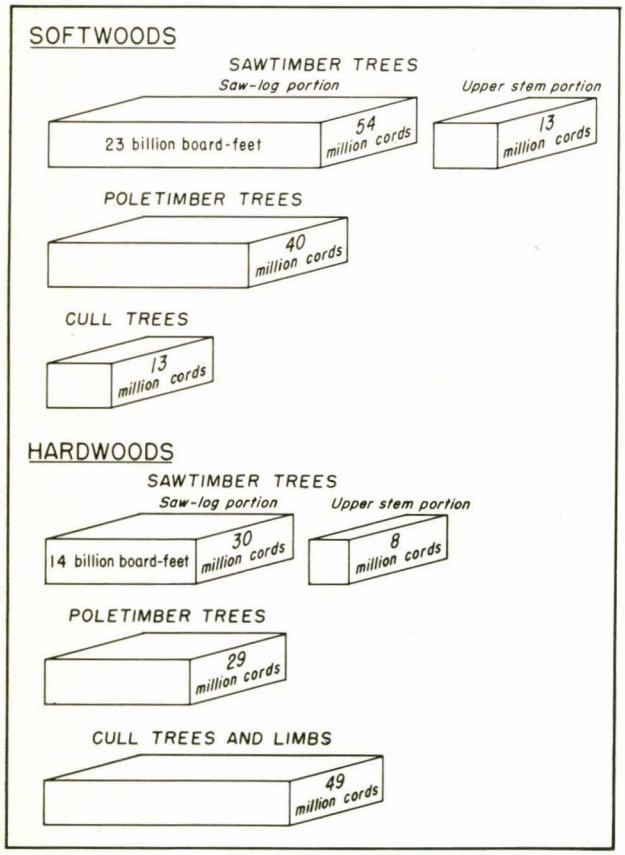

FIGURE 4.—*Net volume of softwood and hardwood timber on commercial forest land by class of material, 1953. Sawtimber and poletimber trees, or growing stock, contain 89 percent of the softwood and 58 percent of the hardwood volume.*

About three-fourths of the sawtimber cut goes into lumber (fig. 5). In 1953, sawmills in Georgia cut 2.2 billion board-feet of lumber. Another 15 percent goes into pulpwood. The remaining small volume of sawtimber cut is used in a wide variety of products, but half of it goes into veneer logs and bolts.

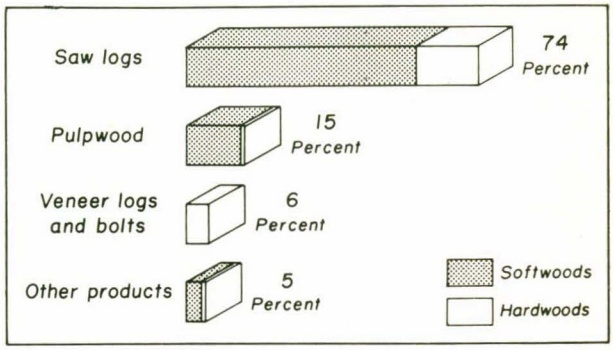

FIGURE 5.—*Percent of the volume of timber products cut from the saw-log portion of sawtimber trees, by product.*

Pine Sawtimber Is the Lifeblood of Forest Industries

Four-fifths of the sawtimber cut is southern yellow pine. The 21 billion board-feet in the stands makes up only 58 percent of the total sawtimber supply. The annual cut is 11.4 percent of the sawtimber volume, compared to an annual growth of 10.7 percent. In relation to the supply, yellow pine is cut twice as heavily as soft hardwoods and more than four times as heavily as hard hardwoods (fig. 6). Currently, the pine cut exceeds growth by 6 percent.

Four species—slash, loblolly, longleaf, and shortleaf pine—make up practically all of the southern yellow pine volume:

	Net volume of live softwood sawtimber, 1953	
	Million board-feet	*Percent*
Yellow pine:		
Longleaf	3,836.5	16.6
Slash	7,215.7	31.2
Loblolly	6,781.4	29.4
Pond	508.2	2.2
Shortleaf	2,750.4	11.9
Virginia	258.9	1.1
Total	21,351.1	92.4
Other softwoods:		
White pine	121.3	.5
Hemlock	48.6	.2
Cypress	1,566.2	6.8
Cedar	24.6	.1
Total	1,760.7	7.6
Total softwoods	23,111.8	100.0

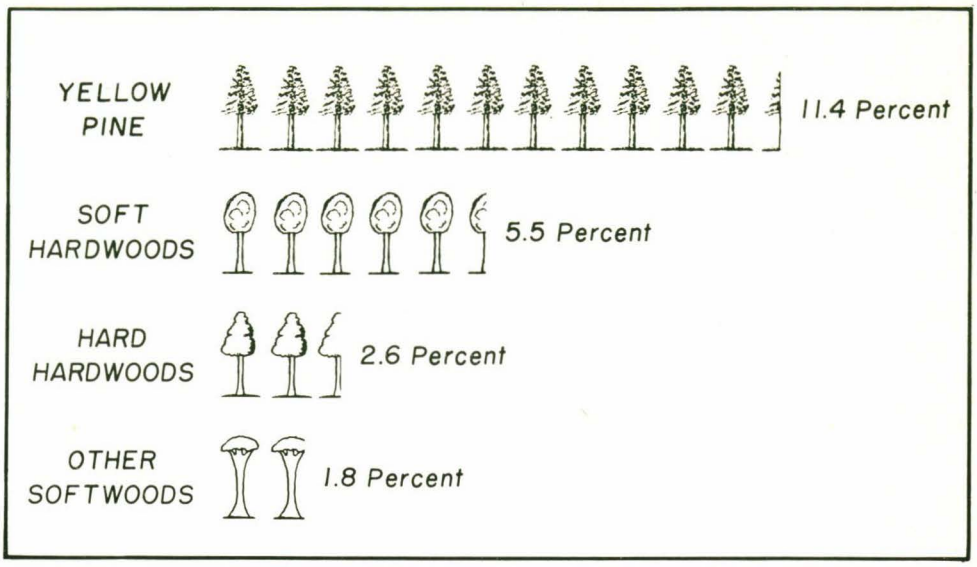

FIGURE 6.—*Percent of the standing sawtimber volume cut annually, by species group.*

Large, slow-growing longleaf and shortleaf pine are preferred for structural timbers because of their greater density and strength. And only longleaf and slash pine are suitable for naval stores. With the exception of longleaf pine, the lumber industry seldom distinguishes between species; it is all sold as southern yellow pine. Pulp mills accept pulpwood from all four pine species without discrimination.

Slash and longleaf pine grow mainly on the sandy coastal plain in the southeastern part of the State, while loblolly and shortleaf are found almost entirely on the heavy upland soils of the central and northern parts.

In addition to the four principal southern pines, a small amount of pond and Virginia pine qualifies as sawtimber. These species are more often cut for pulpwood than lumber because of their tendency to be excessively limby and crooked.

Annually, three-fourths of the yellow pine sawtimber cut is for saw logs, and one-fifth is for pulpwood. These two products account for 94 percent of all products cut from pine sawtimber.

The yellow pines, especially slash pine, with long, clear, slowly tapering boles growing in dense stands in the southern part of the State, are valued for poles and piling. About one-half million poles and over three-fourths of a million linear feet of piling are cut annually. Although these products are important, they account for less than 2 percent of the total volume of products cut from yellow pine sawtimber.

Other products cut include veneer logs and bolts, cooperage, fuelwood, hewn ties, fence posts, farm timbers, and bolts for miscellaneous products. Together they account for only 4 percent of the total volume of products cut from yellow pine sawtimber.

Forest Industries Prefer Large Pine Sawtimber

Forest industries get about 60 percent of the pine sawtimber they use annually from trees 14 inches and larger. This size timber makes up only about 40 percent of the volume of standing pine sawtimber. Nearly a fourth of the pine sawtimber cut comes from trees 18 inches and larger, which contain only 11 percent of the standing pine sawtimber. The cut of pine trees 14 inches and larger is double the growth, and that of trees 18 inches and larger, 3½ times the growth (fig. 7). If more of the large trees existed, forest industries would undoubtedly use them.

Because of the predominance of small trees, the average pine sawtimber tree is only 11.6 inches in diameter at breast height, and contains but 70 board-feet. To the lumber industry, which uses three-fourths of the pine sawtimber cut, small trees mean small logs, high handling costs, and low yields of good-quality lumber. On the other hand, this high proportion of small trees arouses no concern in the pulp and paper industry. Small sawtimber trees are just as well suited for pulpwood as large trees and easier to handle.

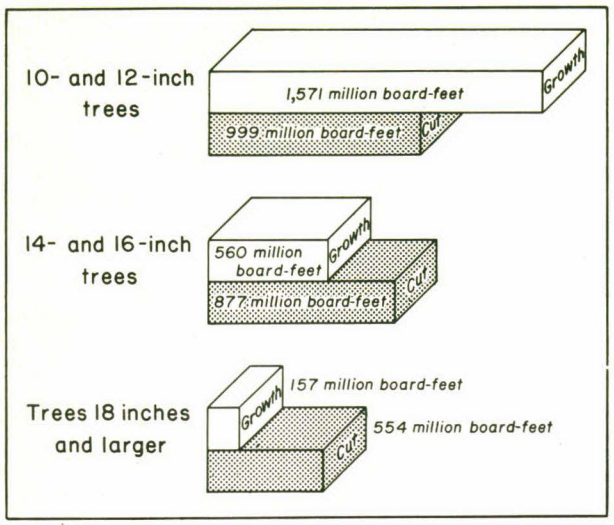

FIGURE 7.—*Current annual growth and cut of pine sawtimber by size of timber. The cut of trees 18 inches and larger is 3½ times the growth.*

Small Amount of Cypress Cut

Of the 1.8 billion board-feet of softwood sawtimber other than yellow pine, 1.6 billion is cypress and the remainder white pine, hemlock, and cedar. These softwoods make up 5 percent of the sawtimber volume, but account for only 1 percent of the volume of products cut. Most of this volume is sawed into lumber. These species are less used, because they are generally less accessible.

Cypress is confined mainly to the coastal plain swamps and river bottoms, where logging is generally much more costly than in the pine stands. Almost a third of the remaining cypress sawtimber is in the Okefenokee Swamp, where no logging is currently in progress. Also, a large part of the cypress volume is in the many small ponds in the coastal plain. Usually the volume is too low to warrant making a special effort to log them, especially since they contain chiefly small, low-quality pond cypress.

The 121 million board-feet of white pine and the 49 million board-feet of hemlock are in trees occurring singly or in small groups widely scattered throughout the mountain hardwood forests. These species are seldom cut except in conjunction with the removal of the hardwoods.

About 25 million board-feet in cedar trees qualifies as sawtimber. These are scattered singly or in small groups throughout the central and northern parts of the State. Very little cedar is sawed into lumber; it is used principally for fence posts.

Hardwood Sawtimber Principal Source of Wood Used in Secondary Manufacture

Georgia has 13.8 billion board-feet of hardwood sawtimber. While hardwood species make up 37 percent of the total volume of standing sawtimber, they provide forest industries with only 19 percent of their annual sawtimber needs. Practically all (93 percent) of the hardwood sawtimber cut is made into lumber and veneer. Only about 2 percent of the cut goes into pulpwood.

Although hardwoods are not used nearly as intensively as pine, they are the principal woods used in manufacture of such finished products as furniture, flooring, and sporting goods. In 1948, nearly three-fourths of all the wood used in manufacturing in Georgia was hardwood species (*16*).

Soft hardwood species make up about half the supply of hardwood sawtimber, as shown in the following tabulation:

	Net volume of live hardwood sawtimber, 1953	
	Million board-feet	*Percent*
Soft hardwoods:		
Black and tupelo gum	2,919.1	21.1
Sweetgum	2,107.4	15.3
Yellow-poplar	1,220.5	8.8
Soft maple	443.6	3.2
Other soft hardwoods	544.6	4.0
Total	7,235.2	52.4
Hard hardwoods:		
White and swamp chestnut oaks	837.6	6.1
Other white oaks	841.5	6.1
Northern red, swamp red, and shumard oaks	498.6	3.6
Other red oaks	2,652.0	19.2
Hickory	863.7	6.3
Ash	293.9	2.1
Other hard hardwoods	586.0	4.2
Total	6,573.3	47.6
Total hardwoods	13,808.5	100.0

The gums and yellow-poplar are the leading species; together they make up 86 percent of the volume of soft hardwoods. Half the remaining volume is soft maple. Other soft hardwoods include southern magnolia, basswood, cottonwood, and buckeye.

While soft hardwoods make up half the volume of hardwood sawtimber, two-thirds of the hardwood timber products cut come from these species, mainly from the gums and yellow-poplar. However, current annual board-foot growth still exceeds the cut by 20 percent, mainly because of the big excess of growth in the little-used, small, low-quality trees. About half the wood of all kinds and two-thirds of the hardwoods

used in manufacturing comes from the gums and yellow-poplar (*16*). The biggest use of gum is for containers, exclusive of cooperage.

Furniture manufacture is the second most important use for soft hardwoods. The furniture industry, not only in Georgia but in adjacent States as well, is especially dependent upon sweetgum and yellow-poplar. These two species, along with tupelo and blackgum, account for 39 percent of all the wood used for furniture in this country.

Only 6 percent of the sawtimber cut annually is hard hardwoods. The oaks are the principal species; they make up about three-fourths of the standing volume of hard hardwoods. Georgia's flooring manufacturing industry, which used about 50 million feet of lumber in 1948, depends principally upon the oaks for raw material.

Other important hard hardwoods include 0.9 billion board-feet of hickory and 0.3 billion feet of ash. Most of the hickory cut is made into handles. Furniture, sporting equipment, and handles are the principal uses of ash.

Short Supply of High-Quality Hardwoods

Georgia's hardwoods are not used as intensively as its pine because much of the volume is in low-quality trees that are not in demand by industry at the present time. Most of the hardwoods cut are for products that require wood free from knots, discoloration, and other defects.

About half the hardwood sawtimber cut comes from trees 20 inches and larger; of this, nearly three-fourths is soft hardwoods. The cut of these large soft hardwoods, which contain less than 10 percent of the volume of standing hardwood sawtimber, is 2½ times the growth. Forest industries make far less use of hard hardwoods than soft hardwoods. Hard hardwood sawtimber growth exceeds the cut in all size classes by a substantial margin; even in trees 20 inches and larger—the size cut the heaviest—growth is one-third greater than the cut (fig. 8).

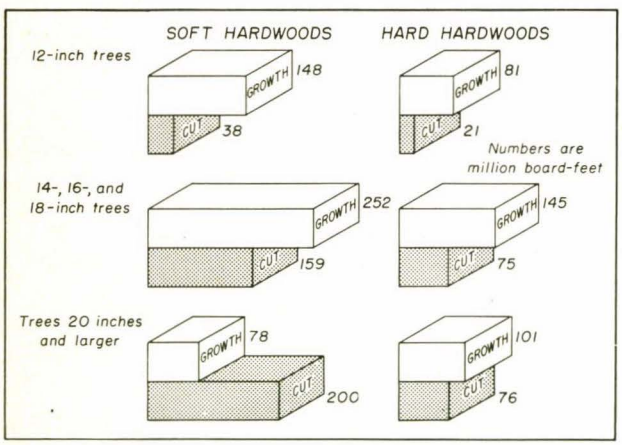

FIGURE 8.—*Current annual growth and cut of hardwood sawtimber by size and species group.*

Because of sweep, knots, and other defects, a large part of the hardwood sawtimber will yield only a very small volume of high-quality lumber or veneer. Three-fourths of the hardwood volume is in Grade 3 logs; only 8 percent is in Grade 1 logs (*29*). Only about a fifth of the lumber cut from Grade 3 logs can be expected to grade No. 1 common or better. Lumber-grade yield studies indicate that only about a fourth of the lumber that could be cut from the present volume of hardwood sawtimber would qualify as Grade No. 1 common or better (*29*).

Low Volume of Sawtimber Per Acre

The low volumes per acre detract considerably from the usefulness of Georgia's sawtimber. Nearly a third is in trees scattered singly or in small groups over 18 million acres of poletimber, seedling and sapling, and poorly stocked stands. These stands have less than 1,500 board-feet per acre; they average about 600.

Stands with more than 1,500 board-feet per acre in them, or sawtimber stands, contain the remaining two-thirds of the sawtimber volume, but make up only 26 percent of the forest area. Only 8 percent of the forest area supports large sawtimber stands, that is, stands with at least half the sawtimber volume in trees 15.0 inches and larger (fig. 9). Even in sawtimber stands, the average volume per acre is low. Very few stands run as high as 10,000 board-feet per acre. Small sawtimber stands average 3,600 board-feet per acre, and large sawtimber stands 5,100 board-feet.

Hardwood types, mainly the lowland hardwood types in the river bottoms bordering the major rivers, contain most of the remaining large sawtimber stands. Nearly half the hardwood sawtimber volume is in large sawtimber stands. By contrast, only 14 percent of the yellow pine is in large sawtimber stands.

Cypress types contain the heaviest stands; large sawtimber stands average 8,300 board-feet per acre. However, the 36,000 acres of large sawtimber in the cypress type contain only 300 million board-feet, or less than 1 percent of the total volume of sawtimber.

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FIGURE 9.—*Large sawtimber stands such as these are becoming increasingly hard to find in Georgia. Only about 2 million acres qualify as large sawtimber stands; less than one-half million acres are pine type.*

Half the Upper Stemwood Cut Is Utilized

In addition to the portion of sawtimber trees suitable for saw logs, there are 21 million cords in the upper stem portion of these standing trees (fig. 4, p. 6). This kind of material makes up 9 percent of the total volume of timber in Georgia.

At the present time, forest industries use about half the upper stemwood cut each year, or almost a million cords—practically all of it pine. Because of the heavy postwar demand for lumber, many pine saw logs now include part of the upper stem which formerly was considered too small, too knotty, or too crooked to make lumber. Recent woods utilization studies indicate that a third of the volume of pine upper stemwood goes into lumber.

Pulpwood is the other major use of upper stemwood. Some pulpwood is cut from tops following saw-log operations, but these tops are generally of such poor quality and so widely scattered that it seldom pays to salvage them unless some additional standing trees are cut. The largest share of the upper stemwood used comes from sawtimber trees cut for pulpwood.

Most of the hardwood upper stemwood cut is left in the woods. What is used is cut mainly for fuelwood.

Large Backlog of Poletimber

Of Georgia's 17.2 billion cubic feet of timber, 29 percent, or 69 million cords, is poletimber (fig. 4, p. 6). This volume comprises 40 percent of the growing stock and is made up of trees 5.0 inches to sawtimber size. Not only are these trees an important potential source of saw logs, but they now provide forest industries with 13 percent of the total annual cut of forest products. About 40 percent of the pulpwood is cut from poletimber. Also, poletimber is the principal source of fence posts.

Poletimber growth exceeds the cut by a substantial margin, but two-thirds of this surplus is in hardwoods (fig. 10). Sixty percent of the pine poletimber growth is cut, compared with only 17 percent of the hardwood. In spite of the comparatively heavy cut of pine poletimber, the surplus growth is still more than enough to offset the pine sawtimber growth deficit. This means that growth of growing stock, which

includes both sawtimber and poletimber, exceeds the cut and is increasing.

Only the large contribution of poletimber ingrowth to sawtimber sizes prevents the current heavy cut of sawtimber from making more serious inroads into the remaining volume of sawtimber. Poletimber ingrowth makes up half the pine sawtimber growth. The large area of abandoned farmland coming back to pine, along with Georgia's big planting program, assures large contributions of pine poletimber to sawtimber growth for some time to come.

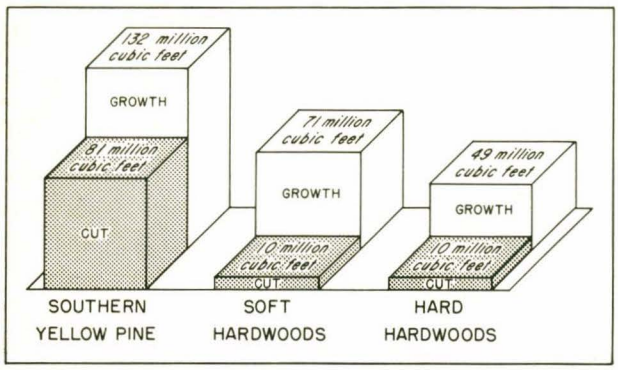

FIGURE 10.—*The annual cut of pine poletimber is 60 percent of the growth; the remaining 40 percent is left in the stands to replenish the sawtimber supply. Hardwood poletimber growth is 5 to 7 times the cut.*

Thirty-seven percent of Georgia's forest area supports poletimber stands. These stands contain 54 percent of the total volume of poletimber and, including the small volume of sawtimber in them, average 7.0 cords per acre. Thirty-eight percent of the poletimber is mixed with the sawtimber in sawtimber stands. These stands, including both poletimber and sawtimber, average 15.6 cords per acre of growing stock. The remaining 8 percent of the poletimber is scattered on 8.8 million acres of seedling, sapling, poorly stocked, and nonstocked stands averaging 1.6 cords of growing stock per acre.

Large Volume of Little-Used Cull Timber

One-fourth of the all-timber volume in Georgia, or 62 million cords, is low-quality timber, including sound volume in cull trees and the limbs of hardwood sawtimber (fig. 4, p. 6). Eighty-two percent of this volume is in cull trees. Most of the culls are sound culls or trees which because of crook, limbiness, or species are either not suitable or show no promise of becoming suitable for saw logs. The remainder are culls because of excessive rot.

More than three-fourths of the cull-tree volume is in hardwoods. Two-fifths of the total soft hardwood and nearly half of the total hard hardwood volume is in cull trees, compared with only 10 percent of the total softwood volume. Scrub oak, other oaks on poor sites, and limby, borer-infested red oaks in the lowlands make up a large share of this volume. Also included among the culls are a large number of oak in the uplands with rot originating from fire scars.

Large timber is more defective than small timber. For example, about half the volume in hardwood trees 13 inches and larger is in cull trees, compared with 39 percent of the volume in trees 5 to 13 inches.

It is estimated that 80 percent of the softwood volume in sound cull trees is usable for such products as pulpwood, fence posts, and farm timbers. The balance is too rough for anything but fuelwood. This provides a backlog of about 9 million cords of softwoods, with an annual growth of about a million cords. Probably not more than 100,000 cords of sound cull softwood timber a year is used for pulpwood.

Half the hardwood volume in sound cull trees, or about 15 million cords, is usable for pulpwood. Very little of this is used for pulpwood at the present time, probably less than 10,000 cords a year. The 8.5 million cords of sound wood in rotten culls, mostly in hardwood trees, and the 11.4 million cords in hardwood limbs have no economic use at this time other than for fuelwood.

Three-fourths of the small amount of cull timber cut is used as fuelwood; this provides a fifth of all fuelwood cut. Sixteen percent of the cull timber goes into pulpwood. This kind of timber, however, makes up less than 5 percent of the total annual pulpwood production. Also cut from this kind of material is a small amount of saw logs, fence posts, hewn ties, and farm timber. Currently, less than 10 percent of the volume of all timber products, including fuelwood, comes from cull timber.

Cull timber in Georgia, most of it hardwoods, is especially concentrated in the oak-gum-cypress type bordering the major streams and rivers and in the mountain area. The lowland oak-gum-cypress type covers only 18 percent of the forest area but contains 40 percent of the cull timber. Stands in these types average 5.5 cords of cull timber per acre, compared to an average of 2.6 for all types. The heavy volume

of cull timber per acre in a belt of counties cutting southwest across the south-central part of the State reflects the large area of oak-gum-cypress type in the wide river bottoms (fig. 11).

In the oak-hickory type, 3½ cords per acre, or 41 percent of the total volume, is in cull trees. The heaviest stands of cull timber in the oak-hickory type are in the mountainous region in the northern part of the State, where this type predominates.

Many pine stands also contain relatively heavy volumes of cull timber; in the loblolly and shortleaf pine types, cull volume averages 2 cords per acre—two-fifths of it in hardwood trees. Oak-pine stands contain nearly three cords of cull timber per acre, most of it in hardwood trees.

No Shortage of Timber for Naval Stores

Three Southern States, Georgia, Florida, and Alabama, produce practically all the turpentine and rosin in this country, with Georgia producing the largest share. National turpentine production has not varied much from 600,000 barrels annually for the past 50 years (*18*). Production during the 1950–51 season equaled the last 50-year peak of 709,000 barrels during the 1938–39 season. Since then, the trend has been down; production dropped to a low of 538,000 barrels during the 1953–54 season. During the 1954–55 season, production regained some lost ground by rising to 618,000 barrels. Like turpentine, the total production of rosin has not varied much in

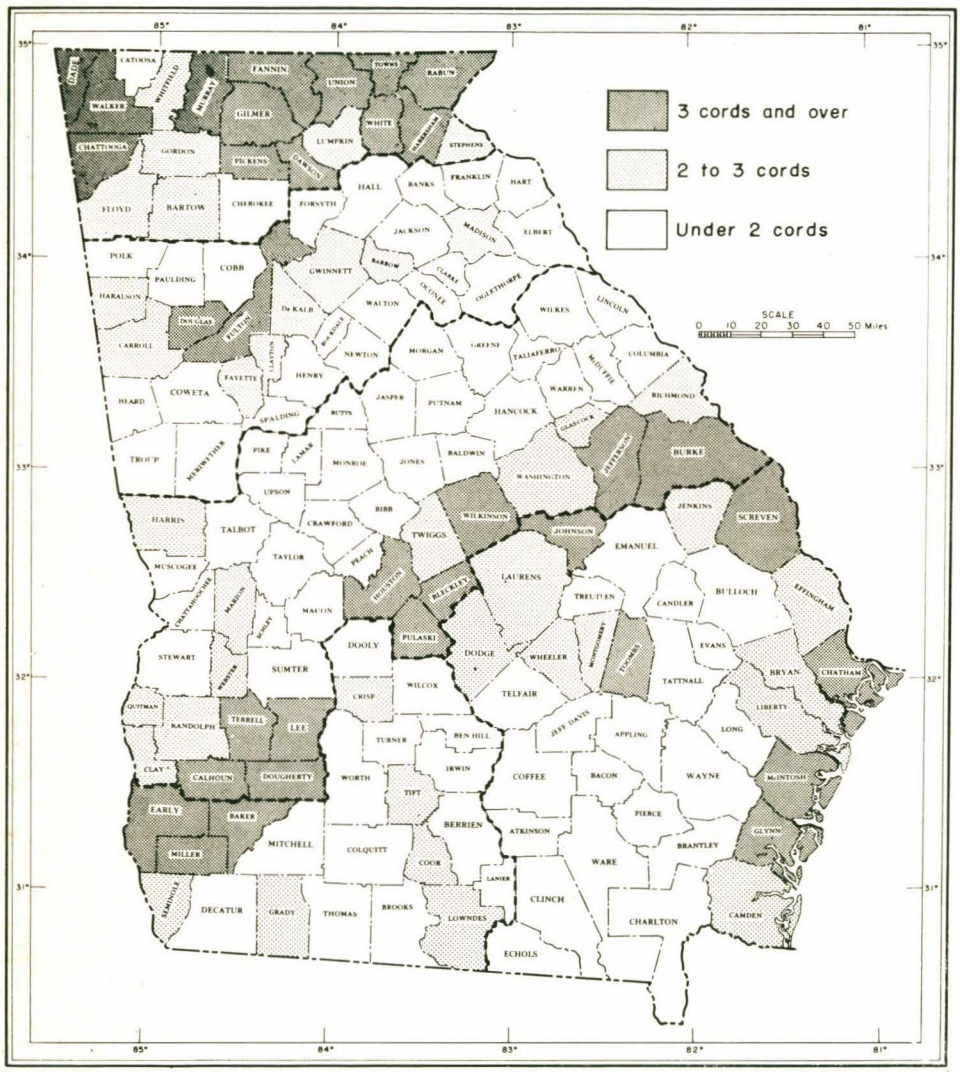

FIGURE 11.—*Cords of hardwood cull timber per acre, by county. Cull hardwood timber is concentrated in the wide river bottoms in the south-central part of the State and in the mountains in the northern part.*

the past. The average has been about 2 million 520-pound drums (*18*). Production during the 1954–55 season was 1.9 million drums.

Decline in Naval Stores From Crude Gum

In the early days, all the turpentine and rosin were produced from the crude gum of slash and longleaf pine. But in the past 15 to 20 years, more and more has come from seasoned old-growth stumps and from pulp mills (fig. 12). In 1936, three-fourths of the rosin and four-fifths of the turpentine was produced from gum (*17*). By 1955, only 28 percent of the rosin and turpentine came from gum (*18*).

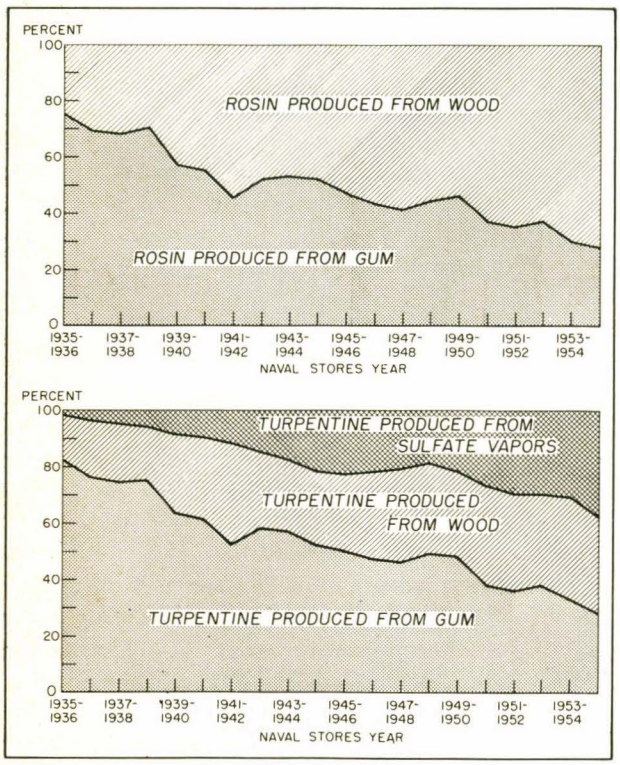

FIGURE 12.—*Percent of national rosin and turpentine production, by raw material source, 1936 to 1955.*

In Georgia, turpentine production from gum dropped from 277,000 barrels during the 1936–37 season to 140,000 barrels during the 1954–55 season, a 49-percent drop. The number of trees worked for gum dropped from 65 million in 1934 to 47 million at the time of the second forest survey during 1950 and 1951 (*23*). During this same period, the turpentine working area dropped from 3.9 million acres to 1.6 million acres.

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The decline in production of gum naval stores has not been as great in Georgia as in other parts of the naval stores belt. While gum production in Georgia has dropped 49 percent since 1936, it has dropped 83 percent in the remainder of the belt. Georgia's share of the total production of gum turpentine jumped from 57 percent in 1936 to 80 percent in 1955.

The drop in gum production can be traced largely to competition from other cheaper sources of turpentine and rosin. In spite of the development of such labor-saving techniques as bark chipping with acid, gum turpentining costs have gone up faster than the price of gum (*20*). This narrow profit margin discourages many landowners from turpentining the trees on their land—especially the increasing number of owners who are managing their land primarily for timber products. At the same time, the slim and uncertain profit outlook has prompted more and more large producers to quit turpentining each year.

It is estimated that not more than 25 to 30 percent of the gum is produced by full-time gum operators working more than 5 crops (50,000 faces). The remainder is produced by farmers who for the most part work on a part-time basis (*24*). Since these operators do not depend upon turpentining for all their income, they are willing to operate on smaller profit margins and can more easily adapt their operations to fluctuations in gum prices than large producers.

No Shortage of Pine Trees for Turpentining

South Georgia has plenty of slash and longleaf pine trees suitable for turpentining. Georgia has a total of 6.2 million acres of slash and longleaf pine type. Active turpentining was in progress on only 1.6 million acres in 1950 and 1951 when the survey was made. On 1.3 million acres, there were 51 million slash and longleaf pine trees 9.0 inches and larger available for turpentining but not being worked—compared with 47 million currently being worked.

Including 39 million round and resting trees scattered throughout the working, resting, and worked-out timber areas,[3] Georgia had about 90 million trees suitable for turpentining which were not being worked at the time the survey was made (fig. 13). If all the trees suitable for turpentining, including working and suitable round and resting trees, were turpentined, Georgia alone could supply 83 percent of the current national turpentine production from all sources.

[3] See appendix p. 46 for definitions.

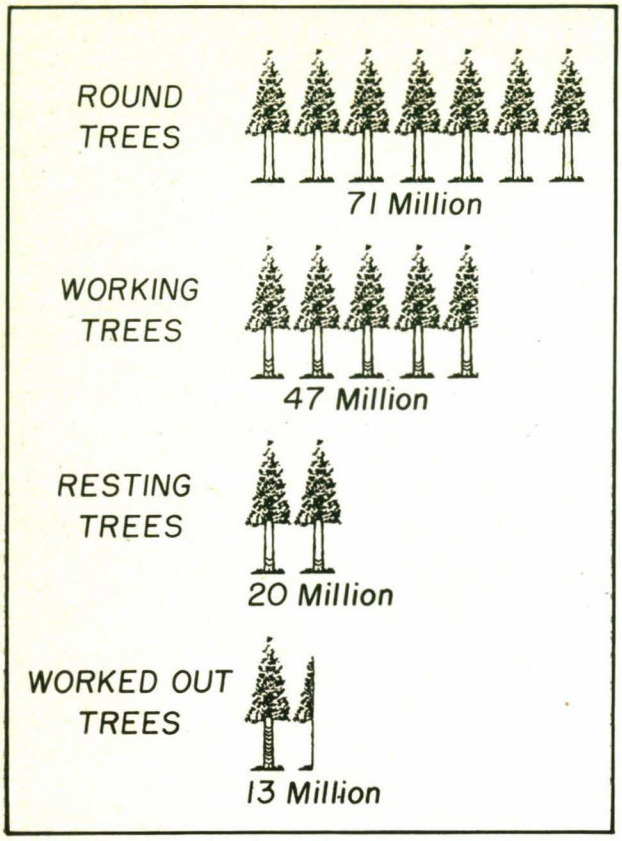

FIGURE 13.—*Number of slash and longleaf pine trees by working status, 1950–51.*

An additional 2.7 million acres of turpentine pine type had less than 15 slash or longleaf pines 9.0 inches and larger per acre on them. Every year a large number of trees from this area attain operating size and further add to the gum-producing potential. Only 165,000 acres in Georgia were classed as worked out.

Turpentining Concentrated in Small Area

Turpentining operations in Georgia are confined almost entirely to the 2 southern survey units, but they are especially concentrated in an 11-county area comprising only 17 percent of the forest area in these 2 units (fig. 14). During 1950 and 1951 nearly half the trees being worked for gum were in this area.

There is little opportunity for expanding gum operations in this 11-county area; 85 percent of the trees readily available for turpentining were currently being worked for turpentine. Elsewhere in the southern part of the State, however, there are large numbers of trees suitable for turpentining, especially in the extreme southeast part (fig. 15). Outside the 11-county concentration area, only 36 percent of the trees in stands suitable for turpentining were being worked.

Increase in Naval Stores From Wood

While the production of gum naval stores is declining, the production of wood naval stores is increasing. In the 1936–37 season a third of the rosin and 20 percent of the turpentine were produced from wood. In the 1954–55 season the wood rosin production reached 72 percent of the total; wood turpentine production made up 34 percent of the total.

Old-growth longleaf and slash pine stumps and other pitch-soaked wood are used in both the destructive and steam distillation processes. The two destructive distillation plants operating in Georgia in 1936 are no longer running. They formerly produced pine tar, pine oil, charcoal, and a small amount of turpentine by placing the wood in retorts and subjecting it to intense heat. The destructive distillation industry has never produced more than a very small part of the turpentine.

Georgia's one large steam distillation plant uses chips from stumps and resinous stem wood, which is first steamed to remove the turpentine and other volatile oil and then boiled in solvents to remove the rosin. This plant depends primarily upon seasoned old-growth slash and longleaf pine stumps in both Georgia and Florida. The future of the industry is tied to the supply of these stumps.

When the survey was made in 1951 and 1952, Georgia had a supply of 23 million tons of stumps scattered over 7.7 million acres. However, only about 11 million tons is considered available to the industry at the present time. The remainder is either in heavily timbered stands or too inaccessible or too widely scattered to be extracted under existing practices. In 1949 there were also 18 million tons of stumps in Florida available to the steam plant in Georgia.

How long this stump supply will last at the current rate of use depends upon a number of factors. For example, part of the area that can be worked for stumps may be inaccessible when dense, young timber becomes established. And, while many of the stumps now inaccessible because of dense timber will become accessible when the timber is harvested, many landowners may not want to delay getting a new stand started for the 2 or 3 years needed to remove the stumps. On the other hand, improvements in

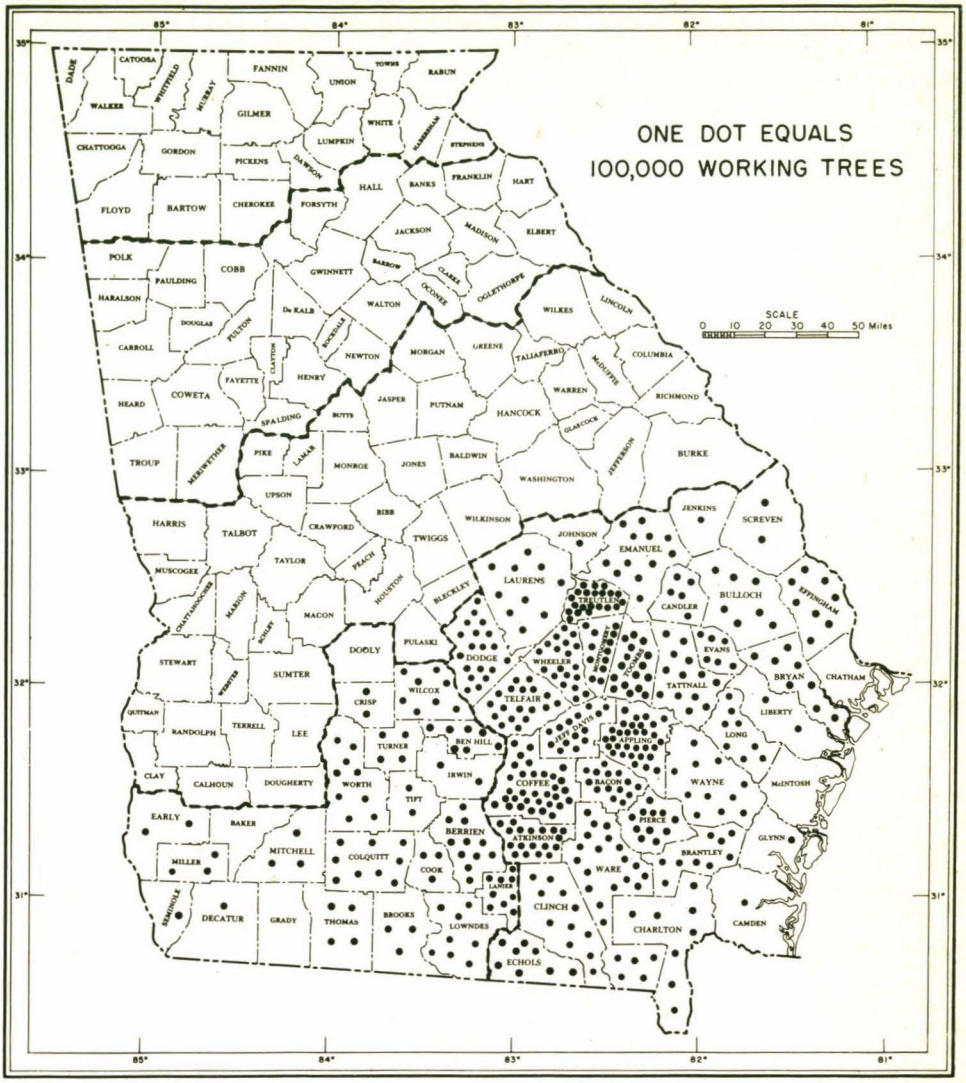

FIGURE 14.—*Distribution of working turpentine pine trees, 1950–51.*

harvesting methods may permit utilizing stumps on areas now uneconomical to operate.

There is no general agreement as to how long the present stump-wood supply will last, but most people connected with the naval stores industry feel that the end is in sight. Thus, if present production levels are to be maintained, the 34 percent of the turpentine and the 72 percent of the rosin that now comes from stump wood will eventually have to come from other sources, probably within the next 20 years.

Pulp Mills a Cheap Source of Turpentine

A cheap and growing source of turpentine is the vapors from the sulfate pulping process. Between 1941 and 1955, the proportion of turpentine from sulfate pulp mills jumped from 12 to 38 percent of the total. Even so, less than half the potential supply from sulfate vapors goes to the naval stores industry at the present time (*21*). Much of it is burned for fuel at the mills.

Sulfate pulp production is expected to reach 7.9 million tons annually by 1955 when plants now under construction are completed. With an average recovery rate of 2.8 gallons of turpentine per ton of pulp, the sulfate turpentine alone could supply four-fifths of the present national production of turpentine if all the mills recovered it.

A production of 10 million tons of sulfate pulp would be enough to supply the present national demand for turpentine. Sulfate pulp production may reach 10 million tons as early as 1960. How much of the resulting sulfate vapor would be used for turpentine is difficult to predict; undoubtedly a large part of it will continue to be burned for fuel.

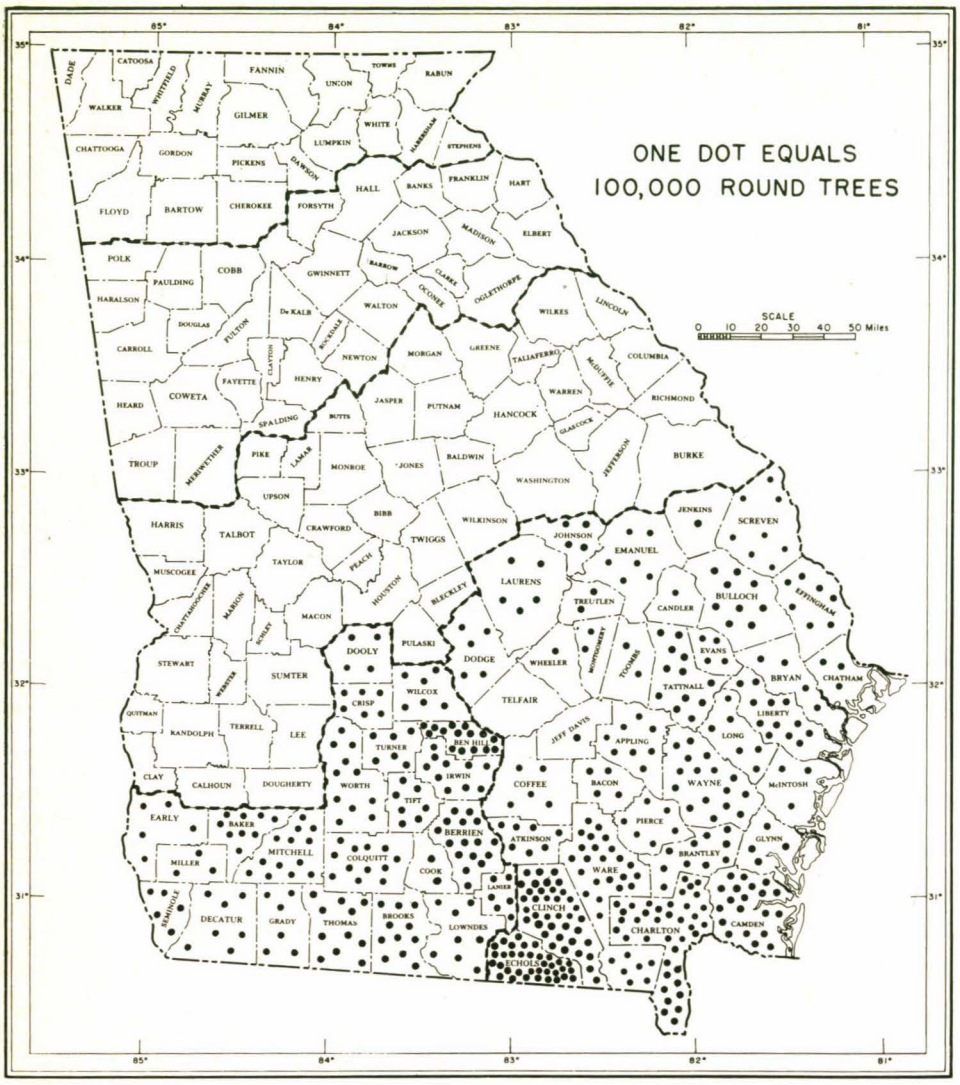

FIGURE 15.—*Distribution of round turpentine pine trees 9.0 inches and larger in unworked stands suitable for turpentining, 1950–51.*

Rosin From Tall Oil

Tall oil, which is refined from "black liquor soap," a byproduct of kraft pulp, provides a cheap and dependable source of rosin. Recent processing methods permit complete separation of tall oil into fatty acids and into hard vitreous rosin comparable to gum and wood rosin (*1*). Tall oil products are used widely by paint and varnish producers and the surface-coating, soap, detergent, paper, and chemical industries. These products are also used by producers of linoleum and other floor coverings, metallic driers, disinfectants, flotation reagents, core oil, and asphalt additives.

In 1953, only about 5 percent of the rosin products came from tall oil (*21*). Processing of all the crude tall oil available from the 6.8 million tons of sulfate pulp produced in 1952 would supply rosin products equivalent to 18 percent of the total rosin production (*21*). With sulfate production at 10 million tons, complete utilization of the tall oil would result in only 25 percent of current rosin production.

In view of the increase in industrial uses for rosin in recent years, the chances are good that requirements will increase. Thus, industries using rosin products, even with full utilization of the tall oil, will still have to rely heavily upon other sources. As stump wood becomes scarce, the main source of rosin will be gum from live pine trees. There are now enough trees available for turpentining in Georgia alone to meet about 90 percent of the present rosin needs of the entire Nation. And every year, growth adds thousands of trees to this potential supply.

Trends in the Timber Supply

Pine Sawtimber Volume Down 15 Percent

GEORGIA HAD 15 percent less pine sawtimber in 1953 than in 1936 when the initial survey was completed. The heaviest decrease was suffered by the north central part of the State, where there is now only half as much pine sawtimber as in 1936 (fig. 16). The drop in central and north Georgia was almost as great. These decreases were in part offset by the 21-percent increase in pine sawtimber volume in the southeast. In the southwestern part of the State, pine sawtimber volume remained about the same.

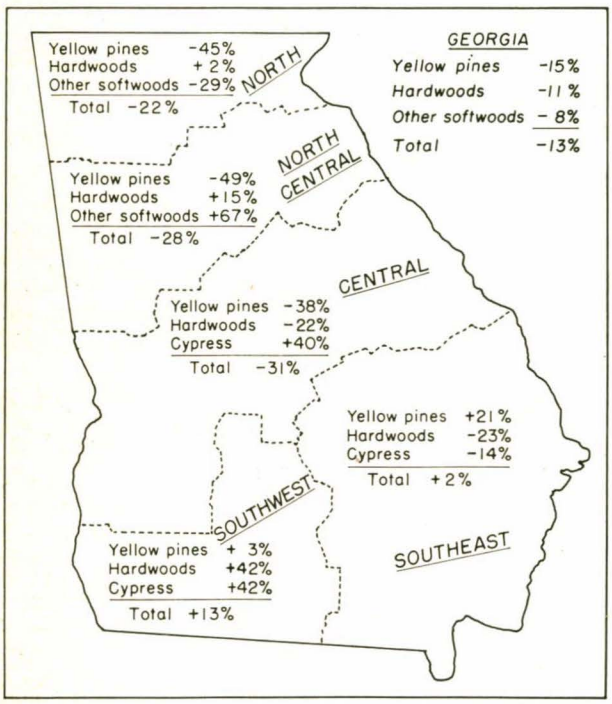

FIGURE 16.—*Percent change in sawtimber volume, by species group, between 1936 and 1953.*

Hardwood sawtimber volume dropped 1.7 billion feet, or 11 percent. The change in hardwood sawtimber volume was not the same as that for pine in the different sections of the State. In the north central unit, where pine dropped so sharply, hardwoods increased 15 percent (fig. 16). In the southeast, where yellow pine volume increased, hardwoods decreased 23 percent. Hardwoods also dropped in the central unit. They increased in the north central unit and remained about the same in the northern unit.

The drop in hardwood sawtimber volume in the central and southeastern units reflects the heavy cutting of old-growth hardwoods in the extensive river bottoms located in these units. Hardwood sawtimber volume increased 42 percent in the southwest (fig. 16).

The drop in the sawtimber volume of other softwoods, which includes principally cypress in the south and a small amount of white pine and hemlock in the central and northern sections, was small. However, because the total volume of these species is small, this change still amounted to a drop of 8 percent. Sawtimber of all species dropped 13 percent.

Poletimber Increase Offsets Sawtimber Drop

For the State as a whole, a big increase in the volume of poletimber between surveys just about offset the loss of sawtimber. The volume in pine trees 5.0 inches and larger, or growing stock, dropped only 2 percent. Hardwood growing stock volume was up 1 percent and the other softwoods remained the same. In 1953 Georgia had about 1 percent less growing stock volume, including all species, than in 1936. In the central and northern sections of the State, this increase in poletimber volume only partly offset the drop in sawtimber. In these areas, growing stock declined, although not as much as sawtimber (fig. 17). In general, the effect has been to replace board-foot volume in trees large enough to make lumber with an equal volume of trees too small for sawtimber.

Sharp Rise in Timber Use

The drop in sawtimber volume is the result of a sharp rise in timber cut since the first survey. In 1953, Georgia's sawmills cut a record 2.2 billion board-feet of lumber, more than double the amount cut in 1936 (fig. 18). Between 1936 and 1953, 30 billion board-

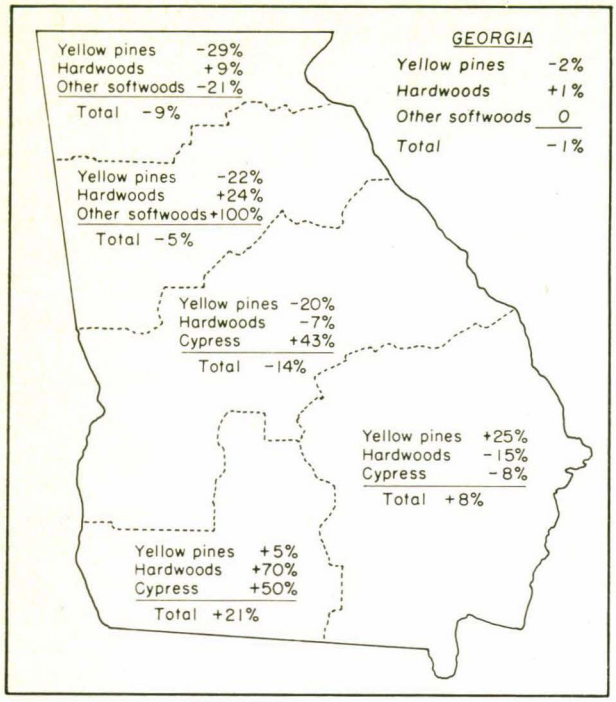

FIGURE 17.—*Percent change in growing stock volume, by species group, between 1936 and 1953.*

feet of lumber was sawed, an average of 1.7 billion a year (*25, 26*). In 1936, 6 out of the 11 Southern States produced more lumber than Georgia. Georgia is now the South's top-ranking producer of lumber (fig. 19, *A*).

In addition to boosting lumber production from a billion to 2.2 billion since 1936, Georgia was able to

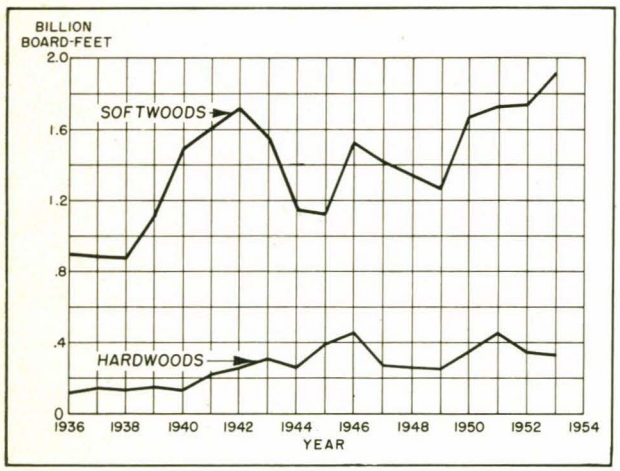

FIGURE 18.—*Lumber production in Georgia, 1936–53. (Source: U. S. Census Bureau, except 1948, which is the average of 1947 and 1949.)*

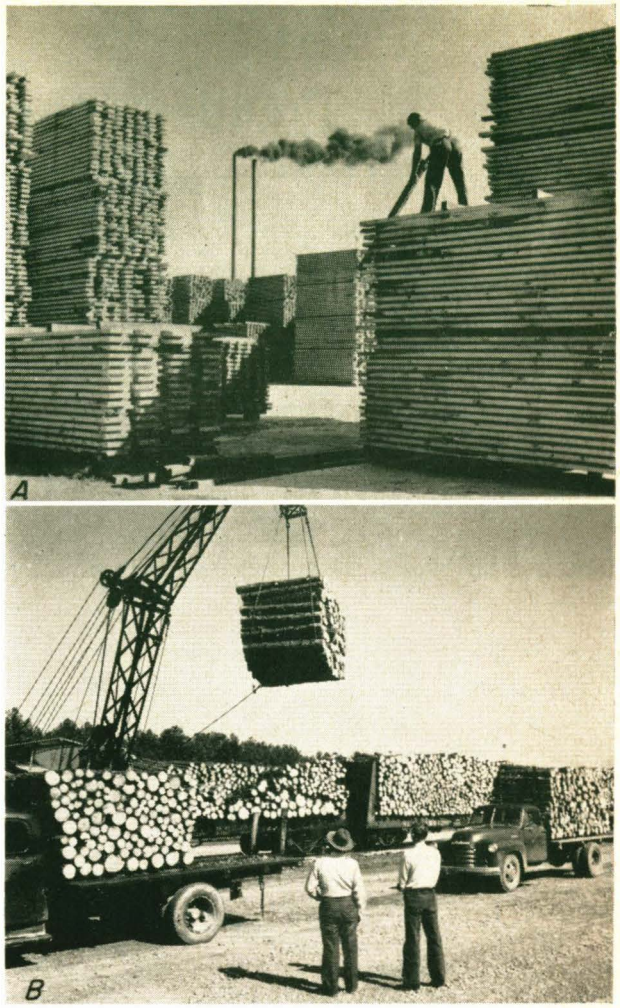

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FIGURE 19.—*A, Sawmills in Georgia cut more than twice as much lumber in 1953 as in 1936. B, Every year since 1946, pulpwood production in Georgia has exceeded the previous year's cut.*

provide wood for a rapidly expanding pulp and paper industry (fig. 19, *B*). Between 1939 and 1953, pulping capacity jumped from 203,000 tons to a million tons (*31*). Most of this expansion took place after 1946. During this period 22 million cords of pulpwood was cut, 21 million cords of it pine. In 1954, pulpwood production in Georgia was 3.1 million cords, more than 5 times what it was in 1939 (fig. 20).

The 88-percent increase in the timber cut for poles and piling—all pine—has added further to the pressure on the timber supply. Timber cut for veneer has more than doubled.

Timber cut for all other products, including fuelwood, cooperage, hewn ties, and farm timber, dropped, but not nearly enough to offset the increase

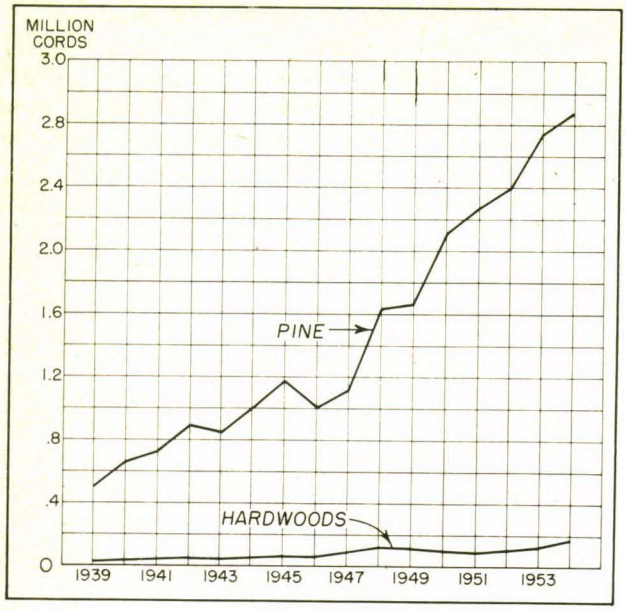

FIGURE 20.—*Pulpwood production in Georgia, 1939–54.*

in timber cut for lumber, pulpwood, and poles and piling. Current sawtimber cut is 83 percent above the 1937 level, and growing stock cut is 87 percent above 1937. Softwood timber took the brunt of the increased cut; the softwood sawtimber cut increased 88 percent, and the cut from growing stock more than doubled.

Pine Sawtimber Still Being Overcut

In view of the sharp rise in timber cut, especially in pine timber, it is not surprising to find that pine sawtimber volume is still dropping almost as fast as it did during the past 18 years. It is currently decreasing at a rate of 0.7 percent a year, for the State as a whole, compared with an average drop of 0.8 percent annually during the period between surveys (fig. 21). The decline would be much greater if it were not for the favorable situation in south Georgia. This area, which contains nearly two-thirds of the pine sawtimber, is growing more than is being cut (fig. 22).

Current annual reductions are severe in the central and northern parts of the State. The average annual decline of 127 million board-feet, accounting for 7.4 percent of the sawtimber volume in the north central unit, underscores the serious shortage of pine sawtimber in this area (fig. 22).

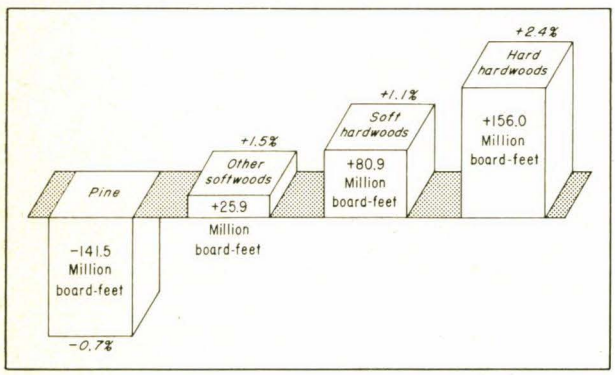

FIGURE 21.—*Current net annual change in sawtimber volume, by species group.*

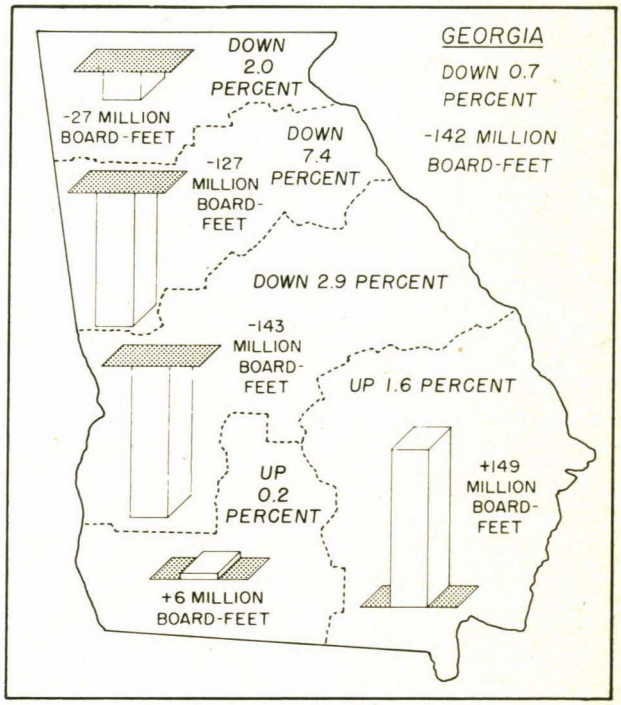

FIGURE 22.—*Current net annual change in pine sawtimber volume, by Forest Survey units.*

Pine Poletimber Increasing

The current annual increase in pine poletimber is slightly more than enough to offset the annual drop in sawtimber. In contrast to the slight drop between surveys, the volume in pine trees 5.0 inches and larger (growing stock) is now increasing slightly—about 0.1 percent a year (fig. 23). However, pine timber is still heavily cut over a large part of the State. On more than one-fourth of the forest area, the annual cut of pine is over 10 percent of the pine growing stock (fig. 24). This is a cutting rate well above the average statewide growth rate of 7.9 percent.

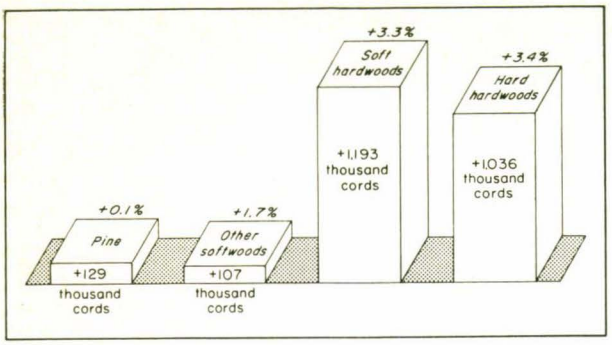

FIGURE 23.—*Current net annual gain in growing stock, by species group.*

Most of the heavy cutting is taking place in the central and northern parts of the State—generally, the same areas which suffered heavy losses of pine volume between surveys. As a result, pine growing stock is dropping at a rate of 2.5 percent a year in the north central unit, and 0.6 percent annually in the central unit. It is just about holding its own in the north and southwest units, and increasing 1.4 percent annually in the southeast.

While the cut of pine doubled in the State as a whole between surveys, the volume of pine growing stock decreased very little. One reason is that the substantial excess of growth over cut during the late thirties allowed the growing stock to build up before the sharp rise in cutting took place in the early forties (*23*). An even more important reason is that the increase in growth has to a large extent kept pace with the increase in timber cut; current growth is 50 percent greater than it was in 1936.

This increase in pine growth reflects a decrease in mortality. The volume of pine trees killed annually by fire, insects, disease, and other miscellaneous

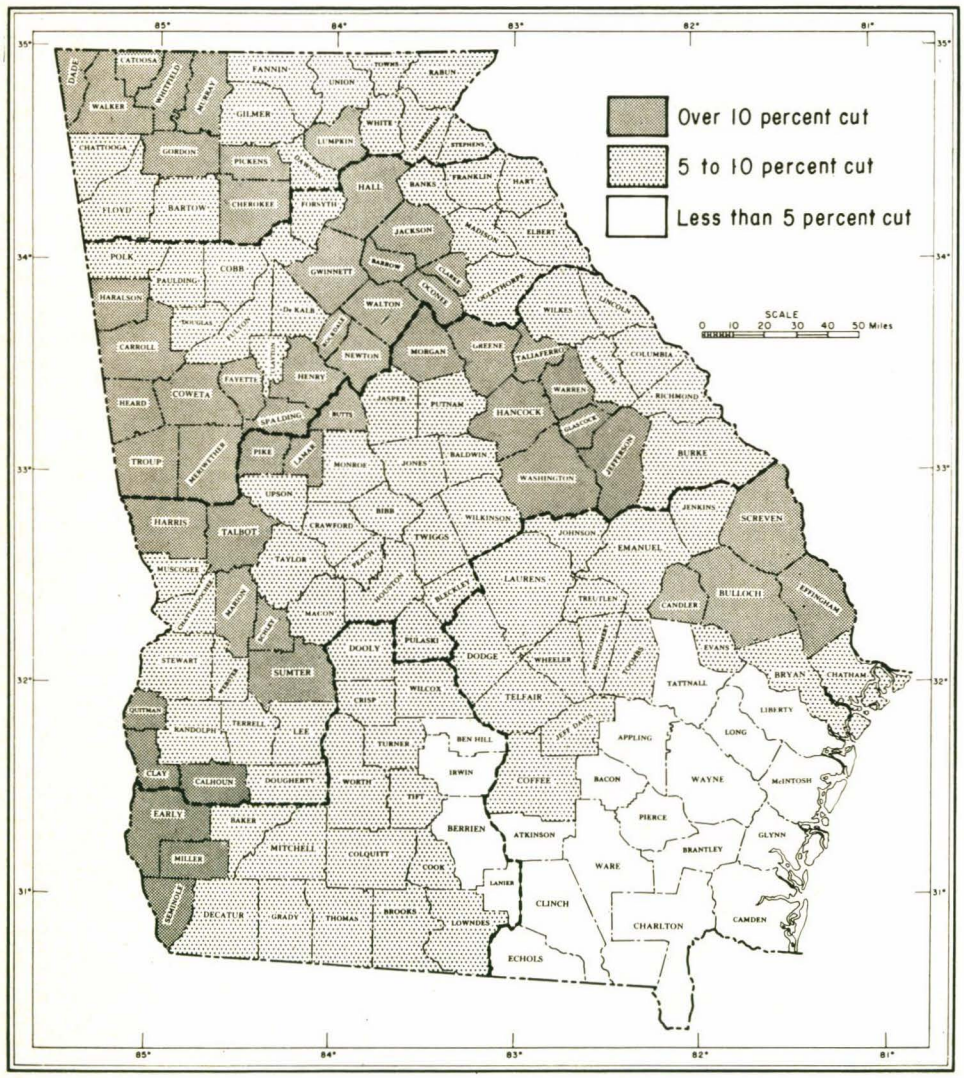

FIGURE 24.—*Percent of pine growing stock cut annually, by groups of counties.*

causes in now only one-fourth of what it was in 1936. Improved fire protection, less turpentining of small trees, and better utilization of worked-out timber have all helped to reduce mortality. An equally important contribution to increased pine growth has been made by the increase in number of small pine trees. Better fire protection has played a part in this as has the leaving of seed trees following cutting, especially in the flatwoods of southeast Georgia.

The number of pine trees in all sizes up through the 10-inch class increased substantially between surveys (fig. 25). The number of 12-inch pines increased 5 percent. Even though the number of pine trees above 12 inches dropped sharply, the net increase for all trees was 41 percent, or enough trees to fully stock a million and a half acres. Because of this rising backlog of young timber, the movement of small trees into sawtimber size (ingrowth) now accounts for half the current annual sawtimber growth.

A large part of this improvement in pine stocking resulted from the seeding in of pine on abandoned farmland. Since the first survey, enough abandoned farmland reverted to forest, in excess of land clearing, to add 2.6 million acres to the forest area. Also, thousands of acres have been planted to pine.

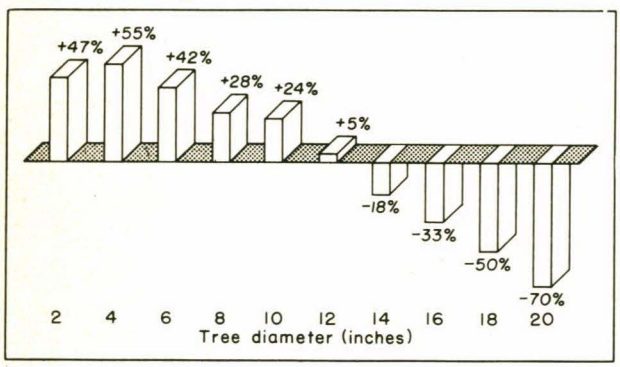

FIGURE 25.—*Percent change in number of pine trees between Forest Surveys, 1936–53.*

Hardwoods Increasing

Sometime during the period between surveys, hardwood sawtimber was overcut, probably during and immediately following World War II. The result was an 11-percent drop during this period. In recent years, however, growth has been increasing faster than the cut. At the time the second survey was made, growth exceeded cut enough to increase the total volume of hardwood sawtimber by nearly 2 percent a year. With the exception of an annual reduction of soft hardwood sawtimber in the north and north central units, which in these areas consists mainly of sweetgum and yellow-poplar, hardwood sawtimber volume was increasing in all parts of the State.

Both soft and hard hardwood growing stock is increasing at a substantial rate in all five survey units in the State. However, most of this increase is in small, low-quality timber. As pointed out in an earlier section, the high-quality gums and yellow-poplars 20 inches and larger are being cut more than twice as fast as they are being replaced by growth.

Twice as Much Volume in Cull Trees

Not only is the volume of hardwood growing stock increasing much faster than pine, but cull trees—especially hardwood culls—are taking up more and more of the available growing space. Cull trees in the stands at the time of the first survey have grown larger, and many have become large enough to be assigned volume. Also, many sound trees have since become cull trees. Because very few cull trees were cut in the period between surveys, the volume has more than doubled. Two-thirds of this increase is in hardwood culls. The volume in cull trees now makes up 23 percent of the total volume, compared with 13 percent at the time of the first survey.

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Forest Land Increasing—Shortage of Desirable Trees

GEORGIA HAS more than enough forest land to grow the amount and kind of timber its forest industries need. Twenty-four million acres, or 65 percent of the land area in Georgia qualifies as forest land. All but a negligible part of this area is either now producing or capable of producing usable timber crops.

In the foreseeable future, the chances are good that Georgia can count on having even more forest land than it has now. During the past 18 years, the area of commercial forest land increased 2.6 million acres, or on the average, 145,000 acres a year.

The area of forest land is not likely to change much in the southern part of the State. In southeast Georgia, 72 percent of the land is already in forest (fig. 26). Most of the land now in forests is unsuitable for agriculture—it is either too low and wet, or too dry and droughty—and land clearing and abandon-

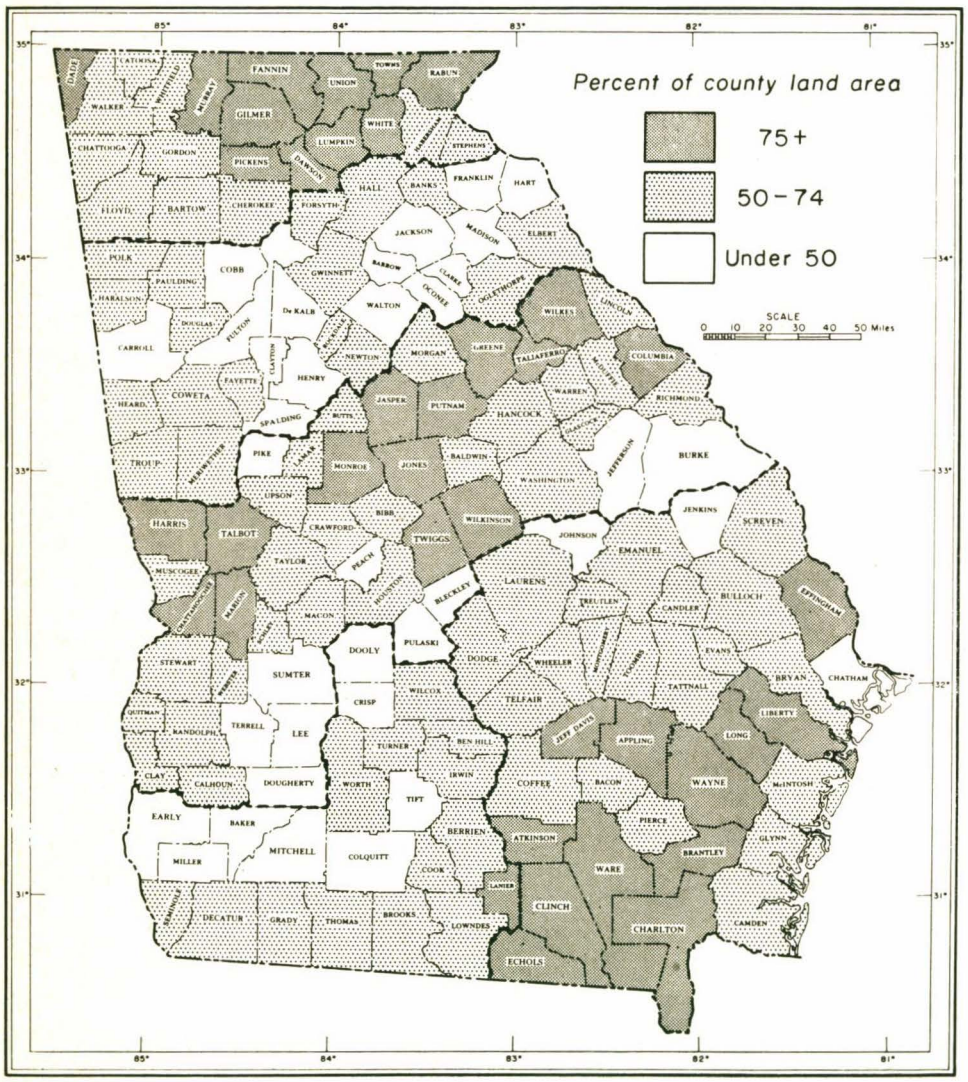

FIGURE 26.—*Percent of land in commercial forest, by county, 1953.*

ment are expected to balance out. Between surveys, the area of commercial forest land in southeast Georgia increased by only 272,000 acres, or an average of 15,000 acres a year (fig. 27). The land-use pattern here seems to have pretty well stabilized.

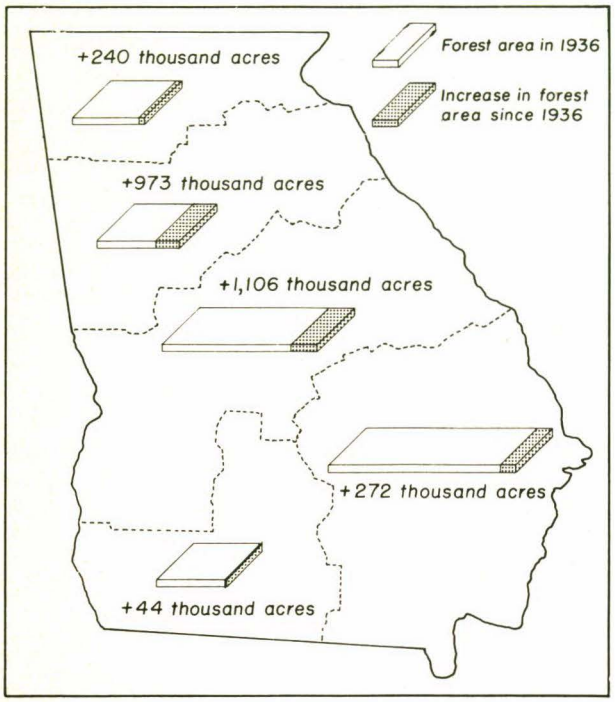

FIGURE 27.—*Increase in forest area since 1936, by Forest Survey unit.*

In southwest Georgia, the area of forest land may possibly drop. Here, large areas are being cleared for pasture. Between 1939 and 1949, the area of cropland pastured increased 70 percent (*27*, *28*). However, during the past 18 years land abandonment has exceeded land clearing by 44,000 acres (fig. 27).

The area available for timber production in the central and northern parts of the State will probably increase. Here the trend appears to be toward farming more intensely a smaller area of the more productive cropland. Some of the land abandoned for cultivated crops is converted to permanent pasture, but a large share of it is left to grow up into shrubs and trees. During the past 18 years, 2.3 million acres, or 128,000 acres annually, in excess of clearing was allowed to revert to forest (fig. 27); the proportion of land in forest has jumped from one-half to two-thirds. All in all, the outlook is for a larger, rather than smaller, area of forest land available for timber production in Georgia.

Abundance of Land to Grow Pine

Except for the low, wet land in swamps and along rivers and streams, and the higher and more remote mountain areas in the north, virtually all the forest land in the State is either now growing pine or has grown pine in the past. On 13.8 million acres (the pine types), pine trees make up half or more of the cubic volume in the stand.[4] On another 2.3 million acres (the oak-pine type), pine trees contain less than half but more than one-fourth of the stand volume.

	Area of commercial forest land[1]	
	Thousand acres	*Percent*
Pine types:		
Longleaf pine	2,731.8	11.4
Slash pine	3,514.0	14.7
Loblolly pine	4,801.2	20.0
Shortleaf pine	2,181.5	9.1
Pond pine	313.0	1.3
Virginia pine	257.7	1.1
White pine	22.4	.1
Total	13,821.6	57.7
Other types:		
Oak-pine	2,337.1	9.8
Oak-hickory:		
Upland hardwoods	2,851.7	11.9
Scrub oak	537.8	2.2
Oak-gum-cypress:		
Lowland hardwoods	4,012.6	16.7
Cypress	408.3	1.7
Total	10,147.5	42.3
All types	23,969.1	100.0

[1] For distribution of forest types, see map inside back cover.

Practically all of the land in the Georgia piedmont, which includes the central, north central, and part of the northern survey units, grew pine at one time or another in the past. There is very little upland area in this region which has not been at some time cleared for agriculture. Pure stands of pine followed abandonment of the land for crops. The oaks, gums, and hickory, which grew on the land prior to the first clearing, became established in the understory of the maturing pine stands. Repeated cutting of the pine eventually left practically pure stands of hardwoods. Thus, it has been demonstrated that a large part of the 2.9 million acres of oak-hickory type is capable of growing excellent stands of pine.

Also, there are in Georgia about one-half million acres of scrub oak type, most of which at one time grew longleaf pine. A large part of this area would still be growing longleaf pine were it not for the lack

[4] Type in seedling and sapling stands is based on numbers of stems and on unstocked clear-cut areas on the former stand.

of seed trees and, in many instances, the dense cover of scrub oak.

In 1953, pine and oak-pine types grew on 67 percent of the forest land. It should be possible to grow pine with comparative ease on at least 80 percent of the forest land in Georgia. Pine and oak-pine types occupied 78 percent of the forest land at the time the first survey was completed in 1936.

The 16.2 million acres of pine and oak-pine types in Georgia include some of the Nation's most productive timberland. On the average, fully stocked pine and oak-pine sawtimber stands in Georgia should be capable of growing at least 600 board-feet, or 2 cords, per acre per year. Present sawtimber stands average only 350 board-feet of growth, or 1.0 cords, per acre annually. Pine grows most rapidly in the central part of the State (fig. 28).

Loblolly is Georgia's most abundant and fastest growing pine. It is the predominating pine on 4.8 million acres, or on 30 percent of the pine and oak-pine types.

	Area		Average site index (feet)[1]
	Thousand acres	Percent	
Longleaf pine	2,731.8	16.9	65
Slash pine	3,514.0	21.8	71
Loblolly pine	4,801.2	29.7	76
Shortleaf pine	2,181.5	13.5	64
Pond pine	313.0	1.9	61
Virginia pine	257.7	1.6	62
White pine	22.4	.1	75
Oak-pine	2,337.1	14.5	70
Total	16,158.7	100.0	70

[1] Total height at age 50 years.

Most of the loblolly pine is growing on the heavy, deep, well-drained upland piedmont soils, where it thrives and makes excellent growth.

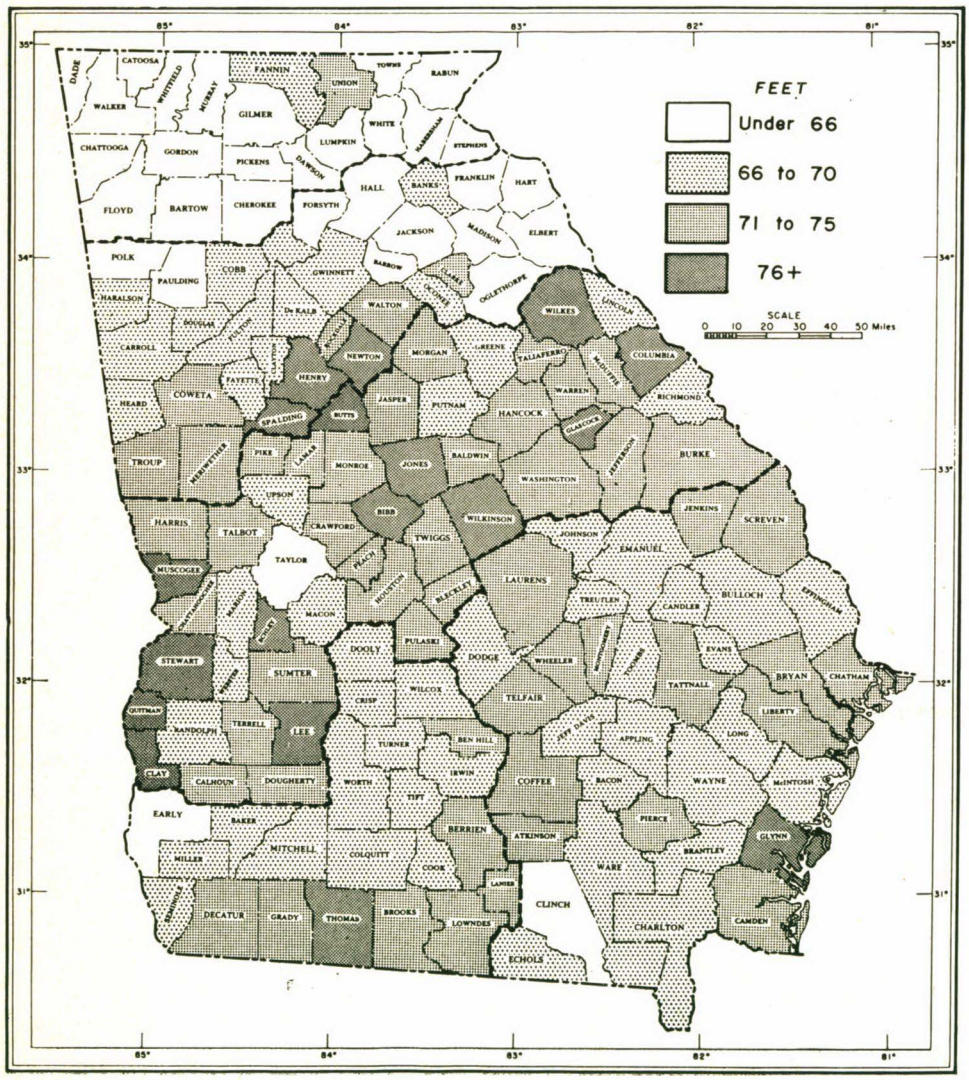

Figure 28.—Average total height of pine trees at 50 years in pine types, by county.

While loblolly pine stands contain the fastest growing pine trees, it is frequently difficult to maintain a high yield of pine per acre because of the strong natural tendency on these heavy piedmont soils for hardwoods to crowd out the pines. As a rule, the better the site, the more aggressive the hardwoods. The decrease in the proportion of forest land in pine and oak-pine types between surveys strongly reflects this tendency for hardwoods to replace pine and revert to original hardwood forest type. There is the possibility that the cost of perpetuating pine on some of the better sites will be so high that it will be more desirable to grow high-quality hardwoods.

On the less productive upland piedmont soils, shortleaf is more common than loblolly pine, especially in the upper piedmont, where the soils and climate are less favorable for the growth of loblolly. Pine trees on the average reach a height of only 64 feet in 50 years on the 2.2 million acres of shortleaf pine type and 62 feet on the 0.6 million acres of oak-shortleaf pine type. A good deal of the shortleaf pine is growing on worn-out, badly eroded, abandoned farmland.

Shortleaf pine types have much the same tendency to revert to hardwood types as loblolly. The resulting hardwood stand, as a rule, is poorer in quality. The trees are shorter, more limby, and defective, and are of the less desirable species, such as southern red oak, black oak, and hickory.

On the lower slopes of the mountains in the north, Virginia pine commonly comes in following cropland abandonment. These pines, which usually grow in very dense stands, are short and exceedingly limby. They have little use except for pulpwood, fuelwood, and fence posts. Most of the 258,000 acres of land covered by Virginia pine types is capable of growing better quality shortleaf pine.

The easiest place to grow pine in Georgia is on the moist, often poorly drained, sandy coastal flatwoods in the southeast. On these sites slash pine attains its best development. While slash pine here does not grow quite as fast as loblolly in the heavy piedmont soils, it is easier to maintain higher pine yields per acre because hardwoods do not compete so aggressively. If an adequate pine seed source is available, the hardwoods, as a rule, are not a hindrance to the establishment of pine. When hardwoods and other shrubby growth do hinder pine restocking, they can be controlled by prescribed burning. In 1953, there were 3.5 million acres of slash pine type in Georgia.

Intermingled among the low, moist sites in the flatwoods are slightly raised, drier sites often made up of coarse sandy soils. Longleaf pine and scrub oak are frequently the only trees hardy enough to survive on many of these dry, often excessively drained, soils. These less productive sites are able to support only sparse stands of slow-growing trees.

Not all of Georgia's 2.7 million acres of longleaf pine type is on droughty, poor, upland soils. There are 1.4 million acres of this type on land with a site index of 65 feet or better. Most of this land is capable of growing slash pine. In the past, because small slash pines are easily killed by fire, repeated burning of the woods pushed this species back to the wettest land, allowing the more fire-resistant longleaf pine to extend to the very edges of the swamps and ponds. With better fire protection, slash pine is reclaiming much of this lost ground. Continued fire protection will very likely result in most of the 1.4 million acres reverting to slash pine.

Landowners in general regard this shift from longleaf to slash pine as desirable. Slash pine trees not only grow faster than longleaf, but also grow in much denser stands, thereby producing heavier yields per acre. Slash pine stands are also much more easily reproduced than longleaf.

Scattered throughout the flatwoods in very wet, poorly drained depressions or ponds are many small patches of pond pine. These sites are relatively unproductive; the trees on them are short, crooked, and seldom attain sawtimber size or quality. All together, pond pine types occupy only about 300,000 acres in Georgia.

Where water stands a good part of the year in ponds, pond cypress is the principal species. These sapling and pole-size trees commonly grow in dense thickets. Cypress areas, like pond pine areas, are numerous but usually small in size. All together there are less than one-half million acres on which as much as 25 percent of the volume in the stand is cypress; most of this acreage is along the river bottoms and in the Okefenokee Swamp.

Half the Pine Stands Are Understocked

Clearly, Georgia is not suffering from a shortage of land capable of growing pine. What it does lack is enough good-quality pine trees to stock this land. Less than half the 13.8 million acres of pine stands, and only slightly more than half the 2.3 million acres of oak-pine stands are fully stocked with trees of growing-stock quality. A fourth of the pine type area and a fifth of the oak-pine, or a total of 4.1

million acres, is less than 40 percent stocked. Nearly a million acres (850,000 acres) of poorly stocked pine and oak-pine types do not have enough desirable seed trees to insure restocking (fig. 29, *A*). A large part of this understocked area is abandoned farmland that has only partially reseeded to pine (fig. 29, *B*).

Pine Stocking Improving

Even though a large proportion of the pine and oak-pine stands are still understocked, these stands are on the average better stocked with pine now than they were 18 years ago when the first survey was made. During this period the number of pine trees 1.0 inch and larger increased by 41 percent. Also, during this same period the area of pine and oak-pine types decreased by 844,000 acres. As a result, while there were only enough pine trees in 1936 to stock 40 percent of the area in these types, there are now enough to stock 52 percent.

The increase in the number of pine trees was sufficient to fully stock 1½ million acres of forest land, or 86,000 acres annually. Not more than a fourth of this increase can be attributed to planting.

In most cases where pine stands were already adequately stocked, the increase in number of pines was not effective. Growth on the additional trees is about offset by the decline in the growth of trees already on the ground caused by increased stand density.

Pine Restocking Hampered By Low-Quality Hardwoods

On a large part of the pine and oak-pine type area, hardwoods are increasing so much faster than pine that they are rapidly filling in the remaining open gaps in the stands, leaving little or no opportunity for an increase in pine stocking. Thus, in spite of the increase in the number of pine trees between surveys, the trend in Georgia is toward less area occupied by pine and oak-pine types, and a smaller proportion of the pine in these remaining stands.

During the past 18 years, the proportion of forest land in pine and oak-pine types has dropped from 78 to 66 percent. This shift has taken place in spite of the 2.6-million-acre increase in forest area, much of which restocked with pine following abandonment for crops. Hardwood type area increased by 3.5 million acres, or 76 percent.

At the present time there are 7.7 million acres of pine types that are not fully stocked. Hardwoods, two-thirds of them culls, occupy about a third of the available growing space on this area; more than half the growing space in the understocked oak-pine types is covered with cull hardwoods. Shrubs occupy a large part of the remaining available growing space. In many places, especially in the loblolly, shortleaf, and oak-pine stands in the piedmont and mountains, this low-grade material is so dense that few pines have a chance of emerging from the heavy understory even though the seed source is adequate (fig. 30).

Unless measures are taken to remove or destroy this undesirable material in the stands, further shifts from pine to hardwood types can be expected. The understory of many pine stands contains mainly hardwoods; on the average, pine trees in pine types occupy only half the growing space taken up by saplings. Many of the oak-pine stands have little or no pine in the understory.

Shortage of Large Pine Trees

The pine stands are fairly well stocked with trees up to and including 12-inch trees; the principal shortage is among trees 14 inches and larger. In a well-managed forest set up to supply sawtimber as well as pulpwood, trees 14 inches and larger should occupy about a fourth of the available growing space. In the present stands this size of timber accounts for only 8 percent of the stocking of all sizes, or only a fifth of the desirable stocking.

The oak-pine type is somewhat better stocked with 14-inch and larger trees than the pine types, but mainly because of better stocking of large hardwoods in some of these stands.

The only way the depleted supply of large pine timber can be replenished without reducing the current level of cutting is to build up the stocking of young trees. As the large trees are cut out, the smaller trees will be made to bear an even greater share of the cut than now. Enough pine trees must be grown to provide for this prospective increase in cut of poletimber and still leave enough in the stands to grow and build up the depleted supply of large timber.

This dependence upon small trees for an increasingly larger share of the lumber cut means higher logging and manufacturing costs, as well as lower quality products. A recent study shows it takes 21 percent more time to saw a thousand board-feet of lumber from 10-inch saw logs than from 14-inch logs (*2*).

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FIGURE 29.—*A, heavy cutting and fire have left nearly a million acres without enough desirable seed trees to insure natural restocking. B, Many thousands of acres of abandoned farmland that have reverted to forest in recent years are only partially stocked. The trees are frequently extremely limby and show little or no promise of becoming sawtimber.*

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FIGURE 30.—*Many areas have an adequate source of pine seed, but the heavy stand of low-quality hardwoods allows very few pine trees to become established.*

Hardwood Stands Poorly Stocked With High-Quality Timber

The State has a total of 7.8 million acres in hardwood types, that is, forest land on which at least 75 percent of the total cubic-foot volume is in hardwood and cypress trees. Over 2 million acres, or 28 percent, of this area is good hardwood growing site capable of growing hardwood timber with at least 3 merchantable 16-foot logs in them (fig. 31). Approximately 4 million acres, or about half the hardwood type area, is fair site capable of growing hardwood trees with 2 merchantable 16-foot logs. On the remaining 1.7 million acres, hardwood trees seldom have more than 1 merchantable 16-foot log in them.

At the present time a very small proportion of the trees in the hardwood types are of a size and quality the site is capable of producing. Although about four-fifths of the hardwood type area is fair to well stocked (40 percent or more) with trees of growing stock quality, a large number of them are under 5.0 inches in diameter. Only about a fourth of the hardwood stands are fair to well stocked with trees 5.0 inches and larger, and only 10 percent with sawtimber. Also, many of these trees, even though they are of growing-stock quality, are the less desirable species such as water, laurel, and willow oak in the lowlands and southern red, scarlet, black, post, and chestnut oak in the uplands.

Although the upland oak-hickory type has almost as much growth potential as the lowland oak-gum-cypress type, the oak-hickory stands at the present time are not nearly as well stocked. Practically all

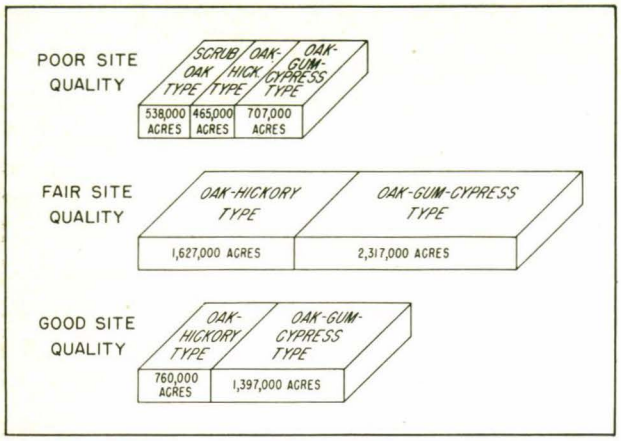

FIGURE 31.—*Area of Georgia's hardwood types, by site quality.*

of the half million acres of scrub oak type is poorly stocked.

The 53-percent increase in the number of hardwoods of growing-stock quality would have been sufficient to stock 2 million acres of forest land if the area of hardwood types had remained the same between surveys. However, as the number of hardwoods increased, the area of hardwood types increased 3.5 million acres, so that on the average the number of trees per acre is less now than at the time of the first survey.

Each year cull hardwoods occupy more and more of the available growing space in the hardwood stands. Between surveys the number of cull hardwoods 5.0 inches and larger nearly doubled. The number of sound hardwood trees this size increased only 18 percent. This means that in the past 18 years cull hardwoods 5.0 inches and larger have taken over more than a million acres of the available growing space, or about 70,000 acres a year. The number of cull hardwood seedlings and saplings probably increased even more. At the present time, 40 percent of the available growing space in hardwood stands is occupied by cull hardwoods. The growing space being occupied annually by the increase in number and size of these cull hardwoods is probably equal to the area planted to pine.

A Look Into the Future

WITH TIMBER CUT AND MORTALITY at the 1953 level, and with the current level of forestry effort, the volume of softwood sawtimber can be expected to continue to drop until 1965 (fig. 32). By this time, the volume will have declined to 20.9 billion board-feet, about 10 percent below what it was in 1953. During this period, an increase in growth, resulting mainly from an increase in the contribution of poletimber to sawtimber ingrowth, will gradually close the gap between cut and growth.

After 1965, board-foot growth will exceed the current level of cutting, but this buildup in volume will be slow. By 1978 the volume of softwood sawtimber will still be 2 percent less than in 1953. The increase in poletimber will more than offset this drop in sawtimber; softwood growing stock can be expected to increase by 5 to 10 percent.

Unless additional forestry measures are taken to increase growth greatly, there appears to be little opportunity for the expansion of industries dependent upon pine in the next 25 years. Because of the decrease in the average size of the timber, along with the trend toward lower volumes per acre and smaller unbroken areas of sawtimber stands, it may be very difficult to maintain the present level of softwood lumber production, let alone expand it. Any substantial expansion in the production of pine pulpwood can be made only at the expense of pine lumber production or by cutting the poletimber heavier. But increasing the cut of poletimber would accelerate the decline in sawtimber.

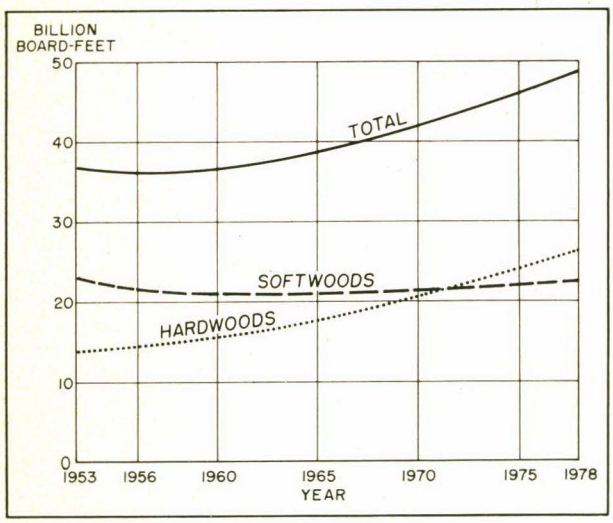

FIGURE 32.—*Probable trend in sawtimber volume, with timber cut and mortality rates at the 1953 level.*

At the present rate of cutting, hardwood growing stock will more than double in the next 25 years. Hardwood sawtimber can be expected to increase 90 percent. Unless there is a shift in the kind of timber cut, most of this increase in hardwood volume will be in small, low-quality trees. By 1978, hardwood timber will make up 55 percent of the total growing stock volume, compared to 39 percent in 1953. Under current cutting practices the volume in cull hardwood trees can be expected to at least double in the next 25 years.

Fire, land-use history, grazing, turpentining, poor cutting practices, and natural ecological tendencies of the land have all played a part in keeping Georgia's forest productivity low. Much progress has been made in recent years toward overcoming these handicaps. Large areas are being put under good forest management. Fire protection is improving. Every year thousands of acres of idle land are planted to pine. The results, which are just beginning to show up, are the first step toward getting Georgia's forests in good growing condition. However, in spite of these improvements, stand deterioration continues. Much remains to be done.

Reduce Fire Damage

Fire kills more timber in Georgia than any other single agent; damage amounts to one-fourth of the total annual timber mortality (fig. 33). The estimated 200,000 to 300,000 cords of pine killed each year is equal to about 10 percent of the annual pulpwood cut (fig. 34). Because this fire-killed timber is

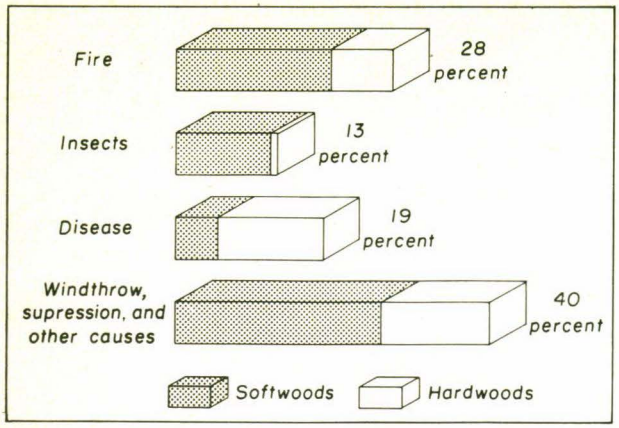

FIGURE 33.—*Growing stock killed by natural causes, not including delayed losses through destruction of seedlings or increase in cull, 1952.*

so scattered and the time in which it can be cut before it deteriorates is so short, only a small amount of it is salvaged.

Even more serious than the volume of timber killed on burned-over forest land is the destruction of countless seedlings and saplings, the future timber crop. This destruction of young trees by repeated burning of the woods down through the years is one of the main reasons why so much of the forest land in Georgia is understocked.

Fire also contributes to the abundance of low-grade hardwoods in the stands. Frequently the establishment of pine following fire is delayed by the lack of an adequate seed source or satisfactory seedbed conditions; the hardwoods readily sprout from the burned stumps and often take over much of the growing space

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FIGURE 34.—*Each year enough pine trees above 5.0 inches to run an average-size pulp mill are killed by wildfires. Even more serious is the killing of countless small trees.*

before the pine gets started. Large areas of longleaf pine type have been converted to scrub oak by just such a process.

In Georgia nearly a third of the cull hardwood trees 11.0 inches and larger are culls because of excessive rot. Twelve percent of the gross board-foot volume of hardwood sawtimber is defective and unusable for lumber. A large part of this unusable defect in both sound and cull hardwoods originates from fire scars.

Georgia has made much progress toward reducing damage from woods fires in recent years. In 1936 Georgia had 5 million acres, or about a fourth of its forest land under organized fire protection. The area protected increased slowly but steadily to 10 million acres by 1948. By 1955 the State had 21.4 million acres under organized fire protection, or about 90 percent of its commercial forest area. All but 22 of the 159 counties in the State were under organized protection by the State Forestry Commission (*7*, *11*).

These efforts to reduce fire damage are paying off. The forest area burned over each year—mostly on unprotected land—dropped from around 5 million acres in the late thirties to less than one-half million in 1954. Fires on the average are smaller. In 1946 half the fires got to be 10 acres or larger before they were put out. In 1954, only a fifth of the fires burned over as much as 10 acres; 26 percent did not exceed a fourth of an acre. In the southeastern part of the State, where forest land has been protected the longest, the stands are better stocked than stands in other sections of the State where fire protection has been in force only a short time.

Organized fire protection is needed for all parts of the State. As of January 1, 1955, 22 counties comprising 10 percent of the forest land were still without organized fire protection.

Special effort is also needed to reduce the number of fires that start. It is estimated that each year over 10,000 fires start on Georgia's forest land (*10*). In 1954, 26 percent of the fires started on protected forest land, or nearly 4,000, were set deliberately (fig. 35). Many more fires of unknown cause were probably incendiary. Incendiary fires are often the most destructive. They frequently start during hazardous weather when the protective organization is busiest. Thus, an intensive effort is needed to get better enforcement of fire laws and to make local people aware of the harm done by indiscriminate burning.

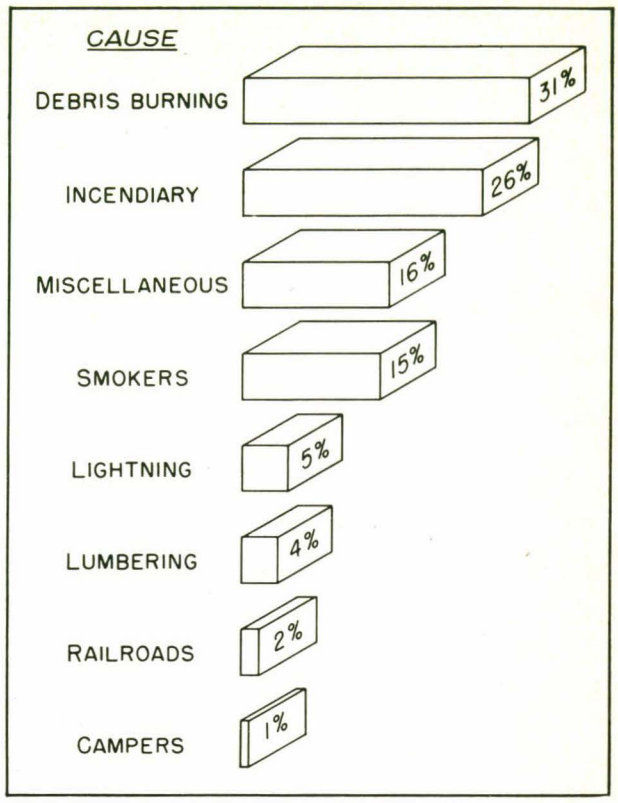

FIGURE 35.—*Percent of fires on protected forest land in Georgia, by cause, 1954.*

Improve Woodland Grazing Practices

People deliberately set fire to the woods for many reasons. Some burn out of malice toward the landowner. Others feel the woods must be burned frequently to rid the woods of snakes and other "varmints." The excitement associated with fire in the woods on a hot, dry, windy day is all the reason some people need to start a fire.

But in the Coastal Plain, at least, the most common reason for deliberately setting fire to the woods is to improve the range for cattle. As long as people can remember, it has been a common practice in southern Georgia to run low-grade scrub cattle, commonly called "piney-woods" cows, in the forest with little or no thought of the man who owns the land. The land was burned frequently, often annually, to keep down the rough and encourage more grass. Although there has been a definite trend in recent years toward better management of cattle and forest lands, burning to improve the range still helps to keep a part of Georgia's forest land understocked.

Experience on the Olustee Experimental Forest in the flatwoods of northeastern Florida, which is similar to the extensive flatwoods of Georgia, indicates that with only native range and "piney-woods" cows the timberland manager is seldom justified in sacrificing timber values to benefit the cattle (*14*). Studies have shown that burning an area every 2 or 3 years is most beneficial to the range, but the damage to timber values is far in excess of the returns from the cattle. However, under proper management some cattle can be grazed on forest land without interfering with timber production (fig. 36).

This means adjusting cattle stocking to the carrying capacity of an annual prescribed burn of 10 to 15 percent of the area instead of the 30 to 50 percent usually preferred by operators who use prescribed burning primarily to obtain better forage (*14*). A cooperative study of herd management on native woodland range indicates that for each cow grazed, at least 6 acres of freshly burned area a year are needed (*22*).

Thus, with burning keyed to the management of the timber and without the use of improved pasture or supplemental feeding, 60 to 90 acres of flatwood forest land are required to provide enough feed for 1 cow. The returns from such yearlong grazing would not be high, but they would materially help in meeting the taxes on the land. Also, grazing is beneficial in reducing the fire hazard by retarding the buildup of flammable undergrowth, mainly gallberry (*22*).

A good deal of the damage to timber in the flatwoods of Georgia caused by fire could be eliminated by burning to fit the needs of the timber rather than the cattle. The landowners themselves are increasingly aware of timber values and are becoming more and more interested in controlling the burning on their land. This is especially true of the larger landowners, those operating forest industries.

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FIGURE 36.—*Although timber is by far the most important source of income from forest land in southern Georgia, it is possible under proper management to allow some grazing without interfering with timber production.*

The big job is that of restraining the people who run cattle on other people's land and have no interest in the timber. Georgia's fence law is a step in the right direction. The prohibiting of grazing without written and duly recorded permits from landowners would also help. In the piedmont and mountain areas of Georgia, where few cattle are grazed in the forest, burning to improve rangeland is not a serious problem.

Control Insects and Diseases

Timber killed by insects and diseases accounted for a third of the annual mortality. This loss amounted to only about two-tenths of one percent of the growing stock. The main job ahead is to keep these losses low. Abnormal buildup of insects and diseases must be quickly detected and prompt action taken to prevent them from assuming serious proportions. Also, good forest management practices, such as thinning to keep trees well spaced and healthy, will help minimize insect losses.

The need for vigilance is illustrated by a recent outbreak of Ips pine engraver beetle damage in a 9-million-acre area in southeast Georgia. Following several years of drought, the volume of timber killed by the Ips bark beetle alone in 1954 in this area was 50 to 75 percent greater than the total mortality caused by insects in 1952. Heavy damage in local areas points to the potential danger of localized outbreaks spreading over extensive areas. Some landowners have lost one-half to three-fourths of the pine trees on their land. One forest landowner in Appling County lost 90 percent of the pine trees on a 50-acre tract. Better ways of preventing such centers of infestation from developing are needed.

Timber loss from littleleaf disease of shortleaf pine is another source of serious timber damage. Surveys show that the disease is abundant on more than a million acres in the central piedmont area in Georgia. On areas where the disease is prevalent, annual mortality rates reach as high as 3 to 5 percent of the growing stock (*4*). The loss of growth by infected trees is perhaps an even more serious loss.

Scattered littleleaf disease occurs on an additional 2½ million acres in Georgia (*8*). Studies show that in this area the disease is becoming more prevalent. Periodic checks of a 1,200-acre area near Newnan, Ga., disclosed that between 1942 and 1951 the proportion of the area affected by the disease increased from 4 percent to 38 (*19*).

At the present time, landowners with littleleaf disease in their stands are advised to arrange a cutting cycle such that most of the infected trees can be salvaged before they die, and to encourage pine species other than shortleaf on areas especially susceptible to littleleaf disease (*4*).

Plantations, because of their uniform age, size, and species composition, are especially susceptible to epidemic outbreaks of insects and diseases. Georgia, with its rapidly increasing area of pine plantations, must be especially alert to detect abnormal increases in the occurrence of insects and diseases in planted areas and to initiate prompt control measures.

Improve Cutting Practices

Annually, there is some timber cut on about 2 million acres, or 8 percent of Georgia's forest land. On more than half of this area, only an occasional tree or small group of trees is cut, usually for fuelwood or for use about the farm. On such areas, cutting did not lower the stand-size class (average size of timber). But on 863,000 acres, cutting reduced the stand-size class; it also reduced the average volume per acre in sound trees from 13.0 cords to 4.4 cords and the sawtimber volume from 3,200 board-feet to 600 board-feet.

Most of the volume left on these heavily cut areas is in low-quality hardwood trees (fig. 37). Before cutting, 70 percent of the volume in both sound and cull trees 5.0 inches and larger was pine, 18 percent in soft hardwoods, and 12 percent in hard hardwoods. Cutting reduced the volume of pine from 9.7 cords per acre to 2.5 cords (fig. 38). Nearly three-fourths of the pine was cut, but only 38 percent of the soft hardwoods and 22 percent of the hard hardwoods were cut. After cutting, pine made up only 47 percent of the remaining volume. Before cutting, 9 percent of the volume was in cull trees, compared to 23 percent after cutting.

This heavy cutting of pine in relation to hardwoods annually converts about 180,000 acres of pine and oak-pine type to hardwood type—more than the area planted to pine in 1955. Also, about 100,000 acres of pine type is converted to oak-pine type annually.

Each year about 350,000 acres of cutover land is left poorly stocked. Some of this land will quickly restock with desirable trees. Much of it, however, will not; annually, about 100,000 acres of cutover land is left without enough seed trees on it to insure

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FIGURE 37.—*The removal of the pine and better quality hardwoods leaves many stands with an overstory of worthless hardwoods. The landowner decided to girdle them to insure the survival of the pine seedings already established in the understory.*

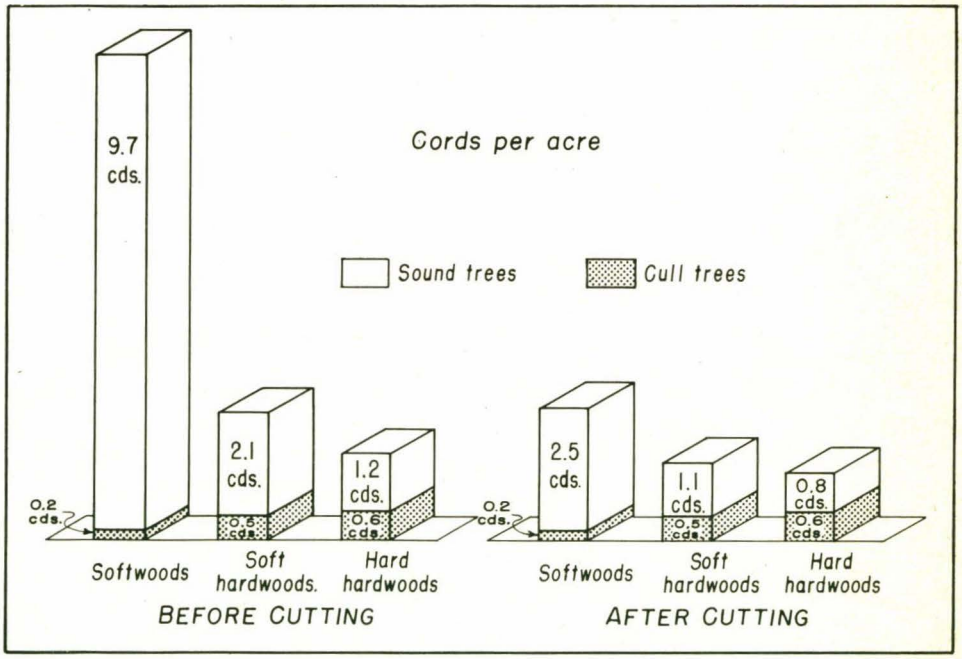

FIGURE 38.—*Total volume per acre, by species and quality class, before and after cutting on land where cutting was heavy enough to change the stand-size class.*

restocking (fig. 39). Such land will require planting to bring it back into timber production. Thus, most of the area annually planted to pine serves merely to offset the annual increase in nonrestocking land caused by heavy cutting.

The first and most important step toward improving cutting practices is to leave the cutover land with an adequate seed source—if logging is not followed by planting. Too often the trees that are left are too small or too unhealthy to produce seed immediately after cutting. By the time they do produce seed, hardwood sprouts and shrubs have taken over most of the land.

Leaving seed trees, however, is by no means the complete answer to stopping damage from poor cutting practices. Only about 5 percent of the cutover land is left without a seed source. Far too often, immature, fast-growing trees are cut which should be left in the stands to replenish the depleted supply of sawtimber. Also, on a great many areas, a way needs to be found to get the low-quality material out of the stand following cutting in order to make room for the regeneration of desirable timber.

Improve Turpentining Practices

The damage to timber stands resulting from turpentining is much less now than when the first Forest Survey was made in 1936. Gum producers now take more care to confine and control fires set to keep the rough down in working stands. With the establishment of the Naval Stores Conservation Program in 1936 and the virtual elimination of the practice of chipping trees smaller than 9.0 inches, timber mortality caused by turpentining has been greatly reduced. The rise of the pulp and paper industry has also helped reduce timber losses. Formerly, worked-out trees that were too small or of too low quality to make saw logs were left in the woods to die or blow over; they are now cut for pulpwood. The number of worked-out trees in the stands has dropped from 24 million to 13 million between surveys.

Also, during the period between surveys, turpentining techniques were developed that greatly lessen the conflict between turpentining and timber production. Such improved practices as bark chipping with sulfuric acid to stimulate gum flow, and the use of

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FIGURE 39.—*While cutting practices have improved in Georgia, it still is not difficult to find areas where all the timber large enough to make small logs and pulpwood has been removed.*

spiral gutters with removable double-headed nails have not only increased the returns from gum production but also improved the quality of worked-out timber.

On the Olustee Experimental Forest, near Lake City, Fla., nails and gutters were removed from trees that had been bark-chipped and treated with sulfuric acid every 2 weeks during the naval stores season for 5 years. These worked-out trees were practically equal in quality to round trees (*12*). Instead of following the usual practice of cutting off the worked part of the tree, the faces were left on the logs. Both the bark-chipped face and the pitch-soaked area beneath were entirely removed in normal slabbing of the logs and edging of the lumber. The presence of the face in no way affected the quality of the lumber.

A recent study showed that bark chipping 20-year-old planted slash pine reduced the volume growth by 26 percent (*30*). This reduction in growth for an average 10-inch tree was less than 2 cents a year at current pulpwood stumpage prices. Since the lease value of a turpentine face on such a tree is about 10 cents a year, the returns from gum far exceeded the loss from growth reduction. An earlier study indicated that bark chipping may reduce the growth of older trees in natural stands even less than young plantation trees. As a rule, comparatively few trees in the stand are turpentined at any one time and then for only a period of about 10 years; thus, the growth loss per acre due to turpentining is very small.

During the 1954 season 18 million faces, or 52 percent of all faces worked, were treated with acid; nearly all of these were chipped with a bark hack. Spiral gutters and double-headed nails were used on 1,772,000 faces. Double-headed nails were used on an additional 557,000 faces, but with tins other than spiral gutters.

The practice of selective cupping further reduces the conflict between gum and timber production. Instead of working all trees above a certain diameter, many landowners turpentine only those trees that should be removed from the stand to improve the quality and growth of the remaining timber. The result is not only greater gum yield from the larger trees, but also better quality timber. However, only 139,000 selectively cupped faces entered the 1953 Naval Stores Program.

The big job in naval stores is to get general adoption of modern techniques.

Improve Forest Practices on Small Ownerships

Private owners not associated with forest industries own three-fourths of the forest land. Farmers own 66 percent of the privately owned forest land; 9 percent is owned by such people as bankers, doctors, and local merchants:

	Area of commercial forest land, 1953	
	Thousand acres	*Percent*
Private ownership:		
Farm	15, 854	66. 2
Lumber manufacturer	1, 462	6. 1
Pulp manufacturer	2, 117	8. 8
Other wood manufacturer	667	2. 8
Other private	2, 187	9. 1
Public ownership:		
National forest	641	2. 7
Other Federal	916	3. 8
State	102	. 4
County and municipal	23	. 1
Total	23, 969	100. 0

The small area of forest land owned by the majority of these private owners constitutes the main obstacle to improving forest practices. The average farmer owns only 92 acres of forest land; other people not associated with the forest industries own, on the average, 95 acres. Very few of these people own enough land to justify the full-time services of a forester.

Cutting on the small private ownerships takes place at infrequent intervals, seldom oftener than every 10 years. For many forest landowners, the harvest cut is a one-time experience. Handling their woodlands, as a rule, commands a small part of their attention compared to their main job of raising cotton or running a hardware business. Many are unaware of the increased woodland returns made possible by good management. Others do not know where to get advice on how to manage their forests. Cutting practices are frequently determined by the owner's immediate need for cash, with little or no thought of the future productivity of the stand.

Only 18 percent of the forest land is owned by forest industries—9 percent by pulp companies, 6 percent by lumber manufacturers, and 3 percent by other wood users. For the most part, these are large ownerships. Pulp companies own, on the average, about 160,000 acres. Lumber companies own, on the average, 1,000 acres, and other wood-using industries about 20,000 acres.

The remaining 7 percent is in public ownership. Federal lands total nearly 1.6 million acres, chiefly military bases, national forests, and wildlife refuges.

Forest land in State ownership amounts to about 100,000 acres.

Forest practices on public and forest industry ownerships are substantially better than on other ownerships. An effort is made to prevent wildfires. Grazing, when allowed, is controlled. Also, turpentining, when permitted, is usually done under approved practices which result in a minimum of damage to the timber.

The favorable forest situation in southeast Georgia reflects to a large extent the prevalence of large forest-industry ownerships. Here, less than half the forest land is in farm ownerships. In contrast, in north central Georgia, where pine sawtimber declined 49 percent between surveys and overcutting is still serious, 90 percent of the land is in farm ownership.

The job ahead is mainly one of getting owners of small- and medium-size forest tracts to practice better forestry. The number of such ownerships in 1953 is shown in the following tabulation:

Size of ownership (acres):	*Area of privately owned commercial forest land (thousand acres)*	*Owners* (number)	(percent)
3–50	2, 398	105, 400	53. 6
50–100	2, 649	40, 360	20. 5
100–500	7, 512	47, 136	24. 0
500–5,000	4, 675	3, 552	1. 8
5,000–50,000	2, 578	204	. 1
50,000 and larger	2, 475	13	. 0
Total	22, 287	196, 665	100. 0

The program of assisting woodland owners conducted by the Georgia Forestry Commission from January 1953 to October 1954 included assistance to only 1,324 owners out of the nearly 200,000 timberland owners in Georgia (*10*). Many more requests for aid are received than can be filled.

Plant Poorly Stocked Areas

Georgia has 1.4 million acres of poorly stocked forest land without enough seed trees to assure prompt restocking. All of this area, which includes a large acreage of abandoned farmland in the initial stage of reverting to forest, is suited to growing pine. This land is at least 10 percent stocked with live trees, but in many instances mainly low-quality sweetgum, sassafras, persimmon, scrub oak, and widely scattered bush-topped pine grow there. Unless planted, this poorly stocked land will yield little but low-quality timber for many years (fig. 40).

In addition to the poorly stocked forest land, Georgia has 2.1 million acres of idle agricultural land. If idle farmland is allowed to revert to forest at the same rate as during the past 18 years, about 145,000 acres would have to be planted each year just to stock the annual increase in abandoned farmland. Some of this area, of course, will restock satisfactorily without planting, but much of it will have to be planted to keep it from reverting to low-value timber.

Enough pine seedlings were distributed to landowners in Georgia during the 1953–54 season to plant 100,000 acres—just about enough to stock the annual increase in cutover forest land not expected to restock naturally (*9*). Practically all these seedlings are grown in four State nurseries. In addition, there is the annual increase in abandoned farmland and the 1.4-million-acre backlog of poorly stocked land that needs planting.

Up to and including the 1953–54 season, enough pine trees had been distributed in Georgia to plant one-half million acres of forest land. It is estimated that enough seedlings will be distributed during the 1954–55 season to plant 120,000 acres. However, because of drought and fire damages, not all the pine plantations are fully stocked. Thus, in spite of the greatly expanded planting program, the area in need of planting is probably increasing (fig. 41).

Make Room for Pine and Desirable Hardwoods

Perhaps the biggest obstacle to increasing the productivity of Georgia's forest land is the large number of cull trees in the stands. Practically all the loblolly and shortleaf pine stands contain cull and low-grade hardwoods that interfere with regeneration and the development of desirable timber. Many of these stands will revert to low-grade hardwoods unless these unwanted trees are removed.

The ideal solution to the problem of getting rid of the larger low-quality timber would be to find a use for it. However, the prospects of utilizing any large quantity of these cull hardwoods appear rather slim at the present time. Georgia has nearly 50 million cords of wood in cull hardwood trees. In 1952, less than one-half million cords was used, mainly for fuelwood. This was only a very small part of the growth.

There appears to be little chance of extending the use of low-quality timber for fuelwood, because the use of wood for fuel is declining. Its use for pulpwood probably can be extended. However, just to cut the annual increase due to growth would require cutting about 2½ million cords. This is almost equal

F-478126

FIGURE 40.—*Abandoned farmland, unless planted, frequently becomes sparsely stocked with limby, open-grown hardwoods and pine, and for many years will yield little but low-quality timber.*

to the volume of pine cut for pulpwood in 1954. In 1954, pulp mills used only 172,000 cords of Georgia's hardwoods, including both sound and cull trees.

While it would be highly desirable to find a use for the cull hardwoods, clearly many landowners are not going to be able to wait until a use is found for them to make room for more desirable timber on their land. They are going to have to kill them.

A recent study of ways of getting rid of cull hardwoods showed that girdling the trunk with a notch is

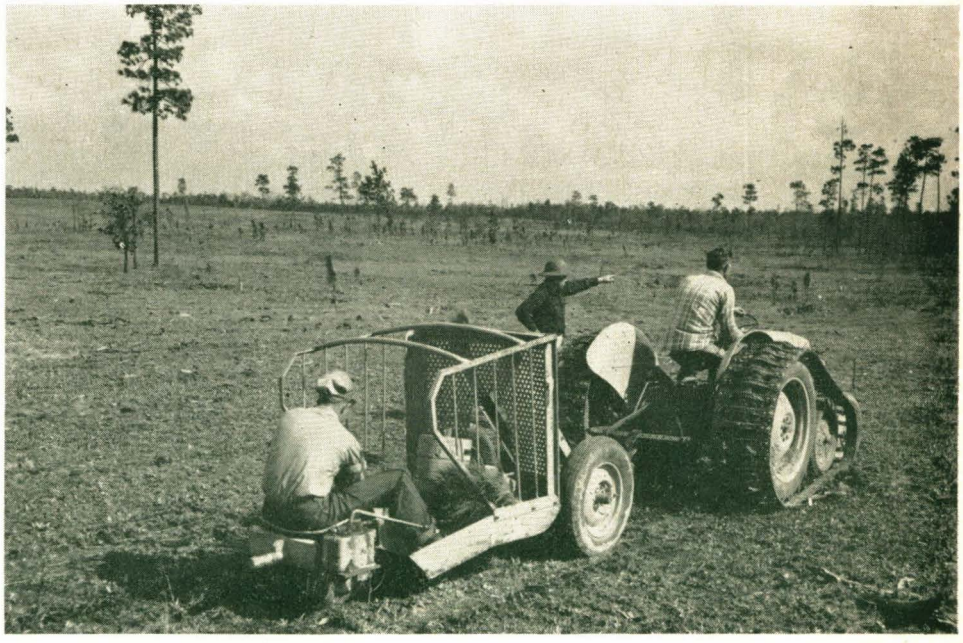

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FIGURE 41.—*During the 1953–54 planting season, enough pine seedlings were distributed to landowners in Georgia to plant 100,000 acres. Many of these were machine planted.*

the simplest and one of the most effective ways of killing large cull trees (fig. 42) (*5*). A slightly cheaper method, and very nearly as effective, consists of chopping frills around the trunk and filling them with 2,4,5–T. Filling the frills with ammate, though slightly more expensive than girdling, is equally effective. Poisoning is especially desirable on medium- and small-size timber, because sprouting is either prevented or reduced.

In some instances prescribed burning is the cheapest and most effective way to get rid of the undesirable seedlings, saplings, and shrubs. This method is particularly effective in the pine stands of the coastal flatwoods region (*3*). However, the use of fire, even under the most carefully controlled conditions, is not practical in any stand where an attempt is being made to grow good-quality hardwoods, since the fire will also destroy or severely damage the desirable hardwoods.

In pine stands outside the coastal flatwood region, though prescribed burning may effectively kill the hardwoods, it may expose the land to serious erosion. More research is needed to determine the susceptibility of the soil in burned-over pine stands to erosion. In some stands, fuel conditions may be such that the prescribed use of fire is very difficult. Fuel may be so scattered that large unburned areas are left, or it may be so concentrated that the heat created kills the large trees.

Obviously, in many instances, landowners must turn to methods other than prescribed burning to get rid of the unwanted undergrowth. These include cutting them with an ax or machete, treating them with chemicals and knocking them down by mechani-

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FIGURE 42.—*One of the simplest and most effective ways of killing large hardwood trees is to girdle the trunk with a notch. Frills chopped around the trunk and filled with 2,4,5–T are almost as effective and slightly cheaper.*

cal means, such as riding over them with a bulldozer or heavy disk.

Considerable progress has been made in working out the technical details of destroying the unwanted hardwoods. The next step is getting widespread use of these methods.

Make the Best Possible Use of Timber Cut

The timber supply responds slowly to improved forest practices. Seedlings planted now, those freed from shrubs and culls, and those saved from fire will not be ready for timber products for at least another 15 to 20 years. In the meantime, the pressure on Georgia's timber supply can be eased to some extent by using as completely as possible the timber that is cut. Less than two-thirds of the timber cut actually goes into the products for which it is cut; about 10 percent is left in the woods, and about 25 percent of the remainder becomes residue during the manufacturing process.

Although the material left in the woods adds up to over a million cords a year, the prospects for using a large part of it are not especially promising. Practically all this volume is in upper stems, excluding limbs. Most of this material is so limby and crooked that it has no use as lumber and is not especially suitable for pulp. A third of it is hardwoods, for which there is practically no present market.

Most of the pine volume left in the woods is in tops following saw-log operations. This amounts to over one-half million cords a year. Some of these pine tops are now being salvaged for pulpwood, but the prospects of greatly increasing their use are not good. Trees are being utilized for saw logs to much smaller top diameters than formerly, which often means that the remaining tops are extremely limby. This material is expensive to collect, and pulp yields are low.

One way to make more complete use of the timber cut is to log the trees for both saw logs and pulpwood at the same time. Some companies accomplish this by removing the timber in tree lengths. The trees are cut up into saw logs and pulpwood at the sawmill. In this way small, poor-quality logs which otherwise might be sawed into unprofitable lumber are diverted to pulpwood.

The use of manufacturing residue affords far more opportunity for easing the pressure on the timber supply than the use of logging residues. The volume of residue available is two to three times greater and much better concentrated.

Sawdust, shavings, slabs, and edgings produced in the course of making lumber make up about 95 percent of the total volume of plant residue produced from the primary manufacture of timber products in Georgia. Four-fifths of it is pine. In 1953 the pine slabs and edgings produced by Georgia's sawmills were equal to approximately a million cords of pulpwood. This includes only the volume in pieces large enough to be chipped, i. e., pieces at least 1 inch thick by 1 inch wide and at least 2 feet long.

As recently as 1952, slabs and edgings had little use except for fuelwood. In the past few years a number of the larger sawmills have installed equipment to take the bark off logs before they are sawed. The bark-free edgings and slabs are chipped for pulp. Other large sawmills are planning to make similar use of their slabs and edgings.

But these larger sawmills produce a very small part of the total present supply of slabs and edgings. For example, in 1947, the most recent year for which lumber production by size of mill is available, there were only 24 mills out of a total of 2,867 mills in Georgia that cut 5 million feet or more. They produced only about 10 percent of the total volume of slabs and edgings.

The big problem, therefore, is finding a way of using the slabs and edgings produced by small sawmills. Debarking and chipping equipment is costly to install and operate; its economical use requires the processing of a steady and substantial supply of wood—more than is produced at most small mills. At the present time it is estimated that only sawmills with a daily production of 20,000 board-feet, or about 5 million feet a year, can fully utilize a log debarker and chipper.

Recently equipment has been developed to debark slabs and edgings, but this equipment, like the log debarkers, is still too costly for most small sawmill owners to install. The main problem is one of getting slabs and edgings to a central point in large enough quantities to keep barking and chipping equipment busy.

Guide the Development of Forest Industries

At the present time opportunities for the establishment of new industries in Georgia, using the already short supply of pine and high-quality gums and yellow-poplar, is very limited. In the central and northern parts of the State, where pine sawtimber and large soft hardwood sawtimber is being cut faster than it is being replaced by growth, there is little room for additional sawmills. Pine poletimber

in this area is increasing, but not enough to offset the heavy cut of sawtimber. Expansion in the use of pine for pulpwood would be at the expense of the growing stock or lumber production.

Some expansion in the use of pine may be possible in the southern part of the State. Pine sawtimber is about holding its own in the southwestern part and increasing in the southeastern part. However, much of this surplus growth is on land held by forest industries where an attempt is being made to build up the growing stock. New industries would probably have to plan on growing a large part of their own timber. Acquiring land for timber-growing purposes may be difficult, because so much of the land here is already owned by forest industries.

Georgia has far more low-grade hardwood timber, however, than its present industries can hope to use. The excess becomes greater every year. There are 50 million cords of cull hardwoods. There are 10 billion board-feet of hardwood timber in low-grade logs (grade 3) which will yield little more than crossties, structural timber, and low-grade lumber. Here is an opportunity for the establishment of industries that are able to use this kind of timber. Information on the location, amount, and quality of this type of timber should be made available to prospective new industries.

The long-term outlook for the establishment of new industries in Georgia is much better than the outlook for the present or immediate future. Georgia has the land area, the soil, and the climate to grow substantially more timber than it is now growing. When this additional growth will be realized depends upon the vigor and promptness of action taken to carry out the following corrective program:

1. Reduce fire damage.
2. Improve woodland grazing practices.
3. Control insects and diseases.
4. Improve cutting practices.
5. Improve turpentining practices.
6. Improve forest practices on small ownerships.
7. Plant nonrestocking land.
8. Get low-quality trees out of the stands.
9. Make more complete use of the timber cut.
10. Guide industrial development toward the unused hardwoods.

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Appendix

Survey Methods and Reliability of Data

IN THE FOREST SURVEY OF GEORGIA, the first step was to make a preliminary estimate of forest land area from aerial photographs. This was followed by a systematic selection of sample plots on the photographs which were later located on the ground by field crews. These plots were carefully cruised to obtain data on timber volume, growth, and timber cut. The county was the basic work unit.

A diligent effort was made to maintain a high degree of accuracy in the collection and compilation of data. In general, the errors that affect the accuracy of Forest Survey area and timber volume estimates arise from two sources. These may be described as (1) sampling errors that result from using sampling procedures rather than making a complete inventory and (2) nonsampling errors that arise from human mistakes in judgment, measurement, recording, or arithmetic.

The sampling errors were held to a specified minimum through survey design and sampling technique. Only these measurable errors entered into computing the reliability of data. Nonsampling errors were minimized or eliminated through training, supervision, field check cruises, and complete editing and machine verification in compiling the data.

Forest Area Estimates

Forest area was estimated by placing a plot grid on every third aerial photograph in alternate flight lines within each county and classifying the land covered by an acre plot by land use, i. e., forest, agricultural, and other uses. The proportion of plots falling on forest land was applied to the gross area of the county, as most recently reported by the Bureau of the Census, to get a preliminary estimate of the acreage of forest land. This estimate was revised after field checks were made of a sample of both forest and nonforest ground plots. Altogether, approximately 296,925 photo plots were classified.

The sampling intensity of the 1951–53 survey provided an estimate of the total forest area in the State with a standard error of ± 0.3 percent. The probabilities are 2 out of 3 that the actual forest area is within ± 0.3 percent of the estimated acreage. The standard error per million acres was ± 1.5 percent.

Volume Estimates

Samples of the grid plots were selected on the photographs for ground examination to obtain volume, growth, cull, and mortality data, and to check the accuracy of the photo land-use classification. The number of ground plots examined depended on the size of the county. An effort was made to take enough ground plots in each county to keep the sampling error of the cubic-volume estimate between 7 and 15 percent. Thus, a larger proportion of the photo plots was often selected for ground examination for small than for large counties in order to keep the volume sampling error below 15 percent. A total of 9,300 forest plots were examined. An additional 2,700 plots classified as nonforest on the photos were examined to check on changes in land-use since the date of photography.

The standard error of the net cubic-foot volume estimate was ± 1.2 percent, or ± 4.3 percent per billion cubic feet. The probabilities are two out of three that the actual volume does not vary from the estimated volume by more than this percentage. The error of the volume in standard cords was not computed but it should be approximately the same.

The standard error of the total board-foot volume estimate was ± 1.4 percent.

Growth Estimates

Measurements for growth calculations were obtained from increment borings taken from mechanically selected trees on ground plots measured for volume estimates. A total of 9,200 samples trees 5.0 inches and larger were bored to determine the rate of

radial growth. In general, computations consisted of adding the volume of small trees that grew to merchantable size to the growth of the trees that were already in merchantable size classes. Growth of cull trees and hardwood limbs was not included.

The diameter growth of each sample tree, including both wood and bark, was computed from its rate of radial growth. The trees were then grouped according to their diameter at the beginning of the 10-year growth period and the increase in sample-tree volume was determined. The rate of volume increase during the period was expressed as an annual percentage through the use of compound interest tables.

The annual growth percentages were applied directly to growing-stock volumes in the same diameter classes. For instance, the average growth of 8-inch trees was based on the growth of sample trees that were 8 inches in diameter at the start of the growth period. Timber mortality was estimated from a tally of trees that died during a 3-year period prior to the time of inventory. Mortality was deducted from total growth to arrive at estimates of net growth.

Growth of turpentined trees was determined by a special field study involving ring counts and radial-growth measurements on stump and stem cross sections of worked-out trees cut on logging and pulpwood operations.

Because of the technical problems involved, no attempt was made to compute the sampling error or growth estimates.

Estimate of Timber Cut

Estimates of the amount of timber cut were based on the number and size of stumps tallied on cutover plots. Stumps of all trees cut during the 3-year period preceding the date of the inventory were recorded, and the measurements were converted into tree volume. The average volume of timber cut for the 3-year period was taken as the annual estimate. The standard error for the total volume of growing stock cut was ± 4.3 percent, or ± 3.8 percent per billion cubic feet. Estimates of the volume cut by product were made from the best available statistics on production.

Public Land Ownership

The boundaries and area of Federal, State, county, and municipal ownerships were obtained from these agencies and plotted on aerial photographs or on photo index sheets. A dot count was made to determine the proportion of forest land. Average volumes per acre were applied to the total forest area by ownership in each survey unit to obtain volume estimates.

Definitions of Terms

Land-Use Classes

FOREST LAND.—Includes (*a*) lands that are at least 10 percent stocked with trees of any size and capable of producing sawtimber or other wood products, and (*b*) lands from which the trees described in (*a*) have been removed to less than 10-percent stocking and that have not been developed for other use; subdivided into the following classes:

Commercial.—Forest land which is (*a*) producing, or physically capable of producing, usable crops of wood (usually sawtimber), (*b*) economically available now or in the future, and (*c*) not withdrawn from timber use.

Noncommercial.—Forest land (*a*) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, or (*b*) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

NONFOREST LAND.—Includes land under cultivation or in pasture where the timber has been cleared to less than 10-percent stocking, idle or abandoned agricultural land, marshland, and land in urban, residential, or industrial areas, schoolyards, cemeteries, roads, railroads, and other rights-of-way.

WATER.—Includes lakes, bays, and estuaries over 40 acres in size, and streams, canals, and sloughs at least one-eighth of a mile in width that are classed as "inland water" by the Bureau of the Census. Smaller lakes and ponds between 1 acre and 40 acres in size, and waterways between 120 feet and 660 feet in width, that are classed as land area by the Bureau of the Census, are also included as water areas.

Forest Types

Forest type is determined on the basis of cubic volume for all stand sizes except seedlings and saplings (stand size 4), in which case the number of stems are the criteria.

PINE TYPES.—Forests in which 50 percent or more of the stand is in pine species. Plurality of volume or number of trees is used to determine the specific type.

OAK-PINE TYPE.—Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern yellow pines make up 25 to 49 percent of the stand.

OAK-HICKORY TYPE

Upland hardwoods.—Forests in which 50 percent or more of the stand is composed of upland oak, hickory, yellow-poplar, maple, gum, and other hardwoods, except where pines comprise 25 to 49 percent of the stand.

Scrub oak.—Upland forests in which 50 percent or more of the stand is composed of scrub oak species, except where pines comprise 25 to 49 percent of the stand.

OAK-GUM-CYPRESS TYPE

Lowland hardwood.—Bottom-land forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, ash, oak, elm, maple, and associated species, except where pines comprise 25 to 49 percent of the stand.

Cypress.—Bottom-land forests in which 50 percent or more of the stand is cypress, except where pines comprise 25 to 49 percent of the stand.

Stand-Size Classes

SAWTIMBER.—Stands containing at least 1,500 board-feet net volume per acre, International ¼-inch log rule, in sound, live, softwood trees 9.0 inches d. b. h. or larger, or hardwood trees 11.0 inches d. b. h. or larger. Two classes of sawtimber stands are recognized:

Large sawtimber.—Stands of sawtimber having more than 50 percent of the net board-foot volume in trees 15.0 inches d. b. h. or larger.

Small sawtimber.—Stands of sawtimber having 50 percent or less of the net board-foot volume in trees 15.0 inches d. b. h. or larger.

POLETIMBER.—Stands failing to meet the minimum sawtimber specifications, but at least 10 percent stocked with trees 5.0 inches d. b. h. or larger and with at least half the minimum stocking in pole-size trees.

SEEDLING AND SAPLINGS.—Stands not qualifying as sawtimber or poletimber stands, but having at least a 10-percent stocking of trees of commercial species and with half the minimum stocking in seedlings and saplings.

NONSTOCKED AND OTHER AREAS.—Forest areas not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Diameters

D. B. H. (DIAMETER AT BREAST HEIGHT).—Stem diameter in inches, outside bark, measured at 4½ feet above the ground.

DIAMETER CLASS.—All trees were tallied by 2-inch diameter classes, each class including diameters 1.0 inch below and 0.9 inch above the stated midpoint, e. g., trees 7.0 to and including 8.9 inches are included in the 8-inch class. Corresponding limits apply to other diameter classes.

Timber Quality Classification

GROWING STOCK

Sawtimber trees.—Live softwood trees at least 9.0 inches d. b. h. and hardwood trees at least 11.0 inches d. b. h., with not less than one merchantable log 12 feet long, or with less than 50 percent of the gross volume of the tree in sound sawtimber. To be merchantable all saw logs must be at least 8 feet long and at least 50 percent sound. They must also meet the following requirements: (1) Softwood logs must have a scaling diameter of 6 inches or larger, and sweep or crook must not exceed two-thirds of the scaling diameter; (2) hardwood logs must have a scaling diameter of 8 inches or larger and must pass specifications for standard lumber logs, or tie and timber logs (*29*).

Poletimber trees.—Straight-boled trees between 5.0 inches d. b. h. and sawtimber size.

Sapling-size trees.—Trees 1.0 inch to 4.9 inches d. b. h. which will grow into poletimber- or sawtimber-size trees of sound quality.

OTHER MATERIAL

Sound cull trees.—Live trees of all sizes that are unmerchantable for saw logs now or prospectively because of species, poor form, excessive limbiness, or other sound defect.

Rotten cull trees.—Live trees of all sizes that are unmerchantable for saw logs now or prospectively because of rotten defect.

Hardwood limbs.—The limb volume of all hardwood sawtimber and cull trees to a minimum diameter of 4.0 inches inside bark.

Species Groups

YELLOW PINES.—Includes longleaf, slash, loblolly, pond, Virginia, and shortleaf pine.

OTHER SOFTWOODS.—Cypress, white pine, hemlock, eastern redcedar, and Atlantic white-cedar.

SOFT HARDWOODS.—Blackgum, tupelo, yellow-poplar, sweetgum, cottonwood, soft maple, basswood, cucumber, willow, and sweetbay.

HARD HARDWOODS.—All the oaks, hickories, ash, beech, elm, river birch, hackberry, sycamore, black locust, mulberry, black walnut, holly, dogwood, and persimmon.

Volume Estimates

BOARD-FOOT VOLUME.—The volume in board-feet, measured by the International ¼-inch rule, exclusive of defect, of that portion of sound sawtimber trees between the stump and the upper limit of merchantability for saw logs.

VOLUME IN CORDS.—For sound trees the volume in standard cords (including bark) of the sound portion of trees 5.0 inches d. b. h. and larger, between stump and a minimum top-stem diameter of 4.0 inches inside bark. Similar volumes are given for cull trees. The volume in limbs, in sections 4 feet long and at least 4.0 inches in diameter inside bark, of all sawtimber-size hardwoods is shown separately.

VOLUME IN CUBIC FEET.—Same as volume shown in cords except bark is not included.

INTERNATIONAL ¼-INCH LOG RULE.—A rule for estimating the board-foot volume of 4-foot log sections, according to the formula $V=0.905\ (0.22D^2-0.71D)$. The taper allowance for computing the volume in log lengths greater than 4 feet is 0.5 inch per 4-foot section. Allowance for saw kerf is ¼ inch.

STANDARD CORD.—A stacked pile, 4 x 4 x 8 feet, of round or split bolts, estimated to contain, on the average, about 73 cubic feet of solid wood.

Growth and Timber Cut

NET GROWTH.—The estimated volume of net growth includes the growth on the present growing stock, the growth on trees that died or were cut during the year, and the ingrowth resulting from smaller trees reaching volume size. It excludes mortality, or loss of volume in trees dying from natural causes. Net growth estimates are based on growth of sound trees. Growth of "other material" is not included.

In board-feet.—The change during the calendar year in sawtimber volume resulting from growth, ingrowth, and mortality losses.

In cubic feet or cords.—The change during the calendar year in the volume of all sound trees 5.0 inches and larger resulting from growth, ingrowth, and mortality losses.

TIMBER CUT.—The volume of growing stock cut or killed by logging and by land clearing and cultural operations on commercial forest land. The volume of timber cut is based on the measurement and tally of stumps found on regular ground sample plots. Stumps of all trees cut during the past 3-year period are recorded and the measurements are converted into equivalent tree volume. The average yearly volume of timber cut for the 3-year period is then taken as the annual estimate. Board-foot volumes include the saw-log portion of all sawtimber-size trees that were cut. Estimates in cubic feet or cords include the entire stem from stump to 4.0-inch top of all sound trees 5.0 inches in diameter and larger.

Gum Naval Stores Conditions

ROUND TIMBER.—A minimum of 15 longleaf and slash pine trees 9.0 inches d. b. h. or larger per acre that have not been worked for naval stores.

WORKING.—Longleaf and slash pine trees that are now being worked for naval stores.

Front-faced.—Turpentine tree species on which the front or first face is now being worked.

Back-faced.—Turpentine tree species on which the front face has been worked out and on which a back (second or third, etc.) face is being worked.

RESTING.—Longleaf and slash pine trees with a worked-out or abandoned front face and on which back-facing has not been started.

WORKED-OUT.—Longleaf and slash pine trees on which two or more faces have been worked out and with no possibility of supporting another face.

Stocking

Stocking is the extent to which growing space is effectively utilized by trees that are now growing stock or show promise of becoming growing stock. The number of stems present by d. b. h. classes was used as a basis for stocking classification. Areas having the minimum numbers of trees listed below, either in a single diameter class or proportionately in any combinations of diameter classes, were considered fully stocked.

D. b. h. class (inches)	*Minimum trees per acre (number)*
Seedlings	1,000
2	800
4	590
6	400
8	240
10	155
12	115
14	90

Standard Tables

To facilitate compilation of forest survey data for any group of States, region, or the Nation as a whole, a standard set of tables is presented in the forest survey report on each State. These tables contain information on forest area, ownership, timber volume, growth, and timber cut. The following tables present this information for the State of Georgia.

TABLE 1.—*Land area by major classes of land, Georgia, 1953*

Class of land	Area
	Thousand acres
Forest:	
Commercial	23,969
Noncommercial:	
Productive-reserved	18
Unproductive	70
Total	24,057
Nonforest [1]	13,372
Total, all classes	37,429

[1] Includes 51,600 acres of Census water created since 1950 and 178,200 acres of water in small lakes and streams defined by the Bureau of the Census as land area.

TABLE 2.—*Commercial forest land area, by ownership and stand-size class, Georgia, 1953*

Ownership class	Total	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked and other areas [1]
Federally owned or managed:	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
National forest	641	285	287	69	
Other	916	311	229	315	61
Total	1,557	596	516	384	61
State	102	39	33	27	3
County and municipal	23	4	9	9	1
Private:					
Farm	15,854	3,876	5,930	4,925	1,123
Industrial and other	6,433	1,840	2,326	1,855	412
All ownerships	23,969	6,355	8,814	7,200	1,600

[1] Includes areas not classified elsewhere.

TABLE 3.—*Area of commercial forest land by major forest types, Georgia, 1953*

Forest type	Thousand acres
White-red-jack pine	22
Longleaf-slash pine	6,246
Loblolly-shortleaf pine	7,553
Oak-pine	2,337
Oak-hickory	3,390
Oak-gum-cypress	4,421
Total	23,969

TABLE 4.—*Net volume of live sawtimber and growing stock on commercial forest land, by stand-size class, Georgia, 1953*

Stand-size class	Sawtimber	Growing stock
	Million bd.-ft.	*Million cu. ft.*
Sawtimber stands	25,735	7,414
Poletimber stands	8,109	4,272
Seedling and sapling stands	2,603	883
Nonstocked and other areas not elsewhere classified	473	123
Total	36,920	12,692

TABLE 5.—*Net volume of live sawtimber and growing stock on commercial forest land, by ownership class, Georgia, 1953*

Ownership class	Sawtimber	Growing stock
	Million bd.-ft.	*Million cu. ft.*
Federally owned or managed:		
National forest	1,577	464
Other	2,388	581
Total	3,965	1,045
State	236	73
County and municipal	39	15
Private:		
Farm	21,387	7,801
Industrial and other	11,293	3,758
Total	32,680	11,559
All ownerships	36,920	12,692

TABLE 6.—*Net volume of live sawtimber and growing stock on commercial forest land, by species, Georgia, 1953*

Species	Sawtimber	Growing stock	Species	Sawtimber	Growing stock
	Million bd.-ft.	*Million cu. ft.*		*Million bd.-ft.*	*Million cu. ft.*
Softwoods:			Hardwoods—Continued:		
Longleaf and slash pines	11,052	3,662	Soft maple	444	193
Shortleaf and loblolly pines	9,532	3,344	Beech	85	19
Other southern yellow pines	767	248	Sweetgum	2,107	769
White and red pines	121	31	Tupelo and blackgum	2,919	1,112
Hemlock	49	9	Ash	294	118
Cypress	1,566	472	Hickory	864	291
Other eastern softwoods	25	7	Cottonwood and aspen	25	6
			Basswood	26	7
Total	23,112	7,773	Yellow-poplar	1,220	378
			Black walnut	5	2
Hardwoods:			Other eastern hardwoods	982	384
White and swamp chestnut oaks	838	307			
Other white oaks	841	302	Total	13,808	4,919
Northern red, swamp red, and shumard oaks	499	133			
Other red oaks	2,652	862	All species	36,920	12,692
Sugar maple	7	6			

TABLE 7.—*Net volume of live sawtimber on commercial forest land, by diameter-class group and species, Georgia, 1953*

Species	Diameter class						Total
	10-inch	12-inch	14-inch	16-inch	18-inch	20-inch and larger	
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwoods:							
Southern yellow pines	6,613	6,202	3,969	2,187	1,165	1,215	21,351
White and red pines	15	21	10	31	14	30	121
Other eastern softwoods	341	407	297	127	119	349	1,640
Total	6,969	6,630	4,276	2,345	1,298	1,594	23,112
Hardwoods:							
White and swamp chestnut oaks		162	160	123	102	291	838
Other white oaks		174	146	121	92	308	841
Northern red, swamp red, and shumard oaks		71	83	78	69	198	499
Other red oaks		492	505	402	368	885	2,652
Sugar maple		1	1	1		4	7
Beech		5	9	17	20	34	85
Sweetgum		485	503	381	293	445	2,107
Tupelo and blackgum		849	801	523	319	427	2,919
Yellow-poplar		253	276	212	199	280	1,220
Other eastern hardwoods		649	644	456	368	523	2,640
Total		3,141	3,128	2,314	1,830	3,395	13,808
All species	6,969	9,771	7,404	4,659	3,128	4,989	36,920

TABLE 8.—*Net volume of all timber on commercial forest land, by class of material and species group, Georgia, 1953*

Class of material	Total	Softwoods	Hardwoods	Class of material	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*		*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Growing stock:				Other material:			
Sawtimber trees:				Sound cull trees	3,031	833	2,198
Saw-log portion	6,623	4,237	2,386	Rotten cull trees	665	83	582
Upper stem portion	1,551	976	575	Hardwood limbs	825		825
				Salvable dead trees	9	3	6
Total	8,174	5,213	2,961				
Poletimber trees	4,518	2,560	1,958	Total	4,530	919	3,611
Total growing stock	12,692	7,773	4,919	Total, all timber	17,222	8,692	8,530

TABLE 9.—*Net annual growth, annual mortality, and annual cut of live sawtimber and growing stock on commercial forest land, by species group Georgia, 1952*

Item	Sawtimber			Growing stock		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Net annual growth	3,174	2,370	804	869	590	279
Annual mortality	242	152	90	80	51	29
Annual timber cut:						
Timber products	2,804	2,160	644	657	522	135
Logging residues	95	39	56	93	51	42
Total	2,899	2,199	700	750	573	177

TABLE 10.—*Output of timber products and annual cut of live sawtimber and growing stock, Georgia, 1952*

Product	Output of timber products					Annual cut of sawtimber			Annual cut of growing stock		
	Volume in standard units		Roundwood volume								
	Standard units	Number	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
			Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Saw logs	M bd.-ft.[1]	2,321,558	388,047	311,544	76,503	2,162,173	1,655,800	506,373	459,833	354,430	105,403
Veneer logs and bolts	do	141,194	22,656	325	22,331	149,025	1,885	147,140	32,199	437	31,762
Cooperage logs and bolts	do	3,178	544	496	48	3,282	2,940	342	654	576	78
Pulpwood [2]	Standard cords [3]	2,511,431	176,531	168,707	7,824	414,310	401,425	12,885	166,866	160,086	6,780
Fuelwood [2]	Standard cords [4]	1,640,332	104,642	49,823	54,819	41,922	31,706	10,216	52,898	29,504	23,394
Piling	M linear feet	748	510	510	----------	2,468	2,468	----------	598	598	----------
Poles	M pieces	517	6,411	6,411	----------	31,640	31,640	----------	7,393	7,393	----------
Posts	do	13,090	8,600	3,952	4,648	5,262	2,418	2,844	5,369	2,467	2,902
Hewn ties	do	1,819	10,823	9,871	952	66,927	60,719	6,208	15,127	13,620	1,507
Mine timbers	M cubic feet	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Miscellaneous [5]	M cubic feet [6]	7,766	7,766	3,539	4,227	22,318	7,795	14,523	8,725	3,940	4,785
Total	----------	----------	726,530	555,178	171,352	2,899,327	2,198,796	700,531	749,662	573,051	176,611

[1] International ¼-inch rule.
[2] Rough wood basis.
[3] Not including 1,629 thousand cubic feet of wood from mill residues used for pulp and other fibre.
[4] Noti ncluding 88,724 thousand cubic feet of wood from mill residues used for domestic and industrial fuel.
[5] Includes chemical wood, excelsior bolts, handle stock, shingle bolts, farm timbers, etc.
[6] Not including 1,767 thousand cubic feet of mill residues used for miscellaneous products.

U. S. GOVERNMENT PRINTING OFFICE: 1957

MAJOR FOREST TYPES - GEORGIA
1953

U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
SOUTHEASTERN FOREST EXPERIMENT STATION
E. L. DEMMON, DIRECTOR

LEGEND

- LONGLEAF-SLASH PINE
- LOBLOLLY PINE
- SHORTLEAF PINE
- OAK-PINE
- OAK-HICKORY
- OAK-GUM-CYPRESS
- WATER
- MARSH

SCALE IN MILES
10 0 10 20 30 40

TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
ALABAMA
FLORIDA
ATLANTIC OCEAN

85° 84° 83° 82° 81°
35° 34° 33° 32° 31°

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